ACCU-Master AUTOMATIC REEL MOWER GRINDER

ASSEMBLY and SERVICE MANUAL

WARNING

You must thoroughly read and understand this manual before assembling or maintaining the equipment, paying particular attention to the Warning & Safety instructions.

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SAFETY INSTRUCTIONS

Safety Awareness Symbols are inserted into this manual to alert you to possible ***Safety Hazards***. Whenever you see these symbols, follow their instructions.

The ***Warning Symbol*** identifies special instructions or procedures which, if not correctly followed, could result in personal injury.

The ***Caution Symbol*** identifies special instructions or procedures which, if not strictly observed, could result in damage to or destruction of equipment.

1. **KEEP GUARDS IN PLACE** and in working order.
2. **REMOVE WRENCHES AND OTHER TOOLS.**
3. **KEEP WORK AREA CLEAN.**
4. **DON'T USE IN DANGEROUS ENVIRONMENT.** Don't use Grinder in damp or wet locations, or expose it to rain. Keep work area well lighted.
5. **KEEP ALL VISITORS AWAY.** All visitors should be kept a safe distance from work area.
6. **MAKE WORK AREA CHILD-PROOF** with padlocks or master switches.
7. **DON'T FORCE THE GRINDER.** It will do the job better and safer if used as specified in this manual.
8. **USE THE RIGHT TOOL.** Don't force the Grinder or an attachment to do a job for which it was not designed.
9. **WEAR PROPER APPAREL.** Wear no loose clothing, gloves, neckties, or jewelry which may get caught in moving parts. Nonslip footwear is recommended. Wear protective hair covering to contain long hair.
10. **ALWAYS USE SAFETY GLASSES.**
11. **SECURE YOUR WORK.** Make certain that the cutting unit is securely fastened with the clamps provided before operating.
12. **DON'T OVERREACH.** Keep proper footing and balance at all times.
13. **MAINTAIN GRINDER WITH CARE.** Follow instructions in Service Manual for lubrication and preventive maintenance.
14. **DISCONNECT POWER BEFORE SERVICING,** or when changing the grinding wheel.
15. **REDUCE THE RISK OF UNINTENTIONAL STARTING.** Make sure the switch is OFF before plugging in the Grinder.
16. **USE RECOMMENDED ACCESSORIES.** Consult the manual for recommended accessories. Using improper accessories may cause risk of personal injury.
17. **CHECK DAMAGED PARTS.** A guard or other part that is damaged or will not perform its intended function should be properly repaired or replaced.
18. **KNOW YOUR EQUIPMENT.** Read this manual carefully. Learn its application and limitations as well as specific potential hazards.
19. **KEEP ALL SAFETY DECALS CLEAN AND LEGIBLE.** If safety decals become damaged or illegible for any reason, replace immediately. Refer to replacement parts illustrations in Service Manual for the proper location and part numbers of safety decals.
20. **DO NOT OPERATE THE GRINDER WHEN UNDER THE** INFLUENCE OF DRUGS, ALCOHOL, OR MEDICATION.

SAFETY INSTRUCTIONS

IMPROPER USE OF GRINDING WHEEL MAY CAUSE BREAKAGE AND SERIOUS INJURY.

Grinding is a safe operation if the few basic rules listed below are followed. These rules are based on material contained in the ANSI B7.1 Safety Code for "Use, Care and Protection of Abrasive Wheels". For your safety, we suggest you benefit from the experience of others and carefully follow these rules.

DO

1. **DO** always **HANDLE AND STORE** wheels in a **CAREFUL** manner.
2. **DO VISUALLY INSPECT** all wheels before mounting for possible damage.
3. **DO CHECK MACHINE SPEED** against the established maximum safe operating speed marked on wheel.
4. **DO CHECK MOUNTING FLANGES** for equal and correct diameter.
5. **DO USE MOUNTING BLOTTERS** when supplied with wheels.
6. **DO** be sure **WORK REST** is properly adjusted.
7. **DO** always **USE A SAFETY GUARD COVERING** at least one-half of the grinding wheel.
8. **DO** allow **NEWLY MOUNTED WHEELS** to run at operating speed, with guard in place, for at least one minute before grinding.
9. **DO** always **WEAR SAFETY GLASSES** or some type of eye protection when grinding.

DON'T

1. **DON'T** use a cracked wheel or one that **HAS BEEN DROPPED** or has become damaged.
2. **DON'T FORCE** a wheel onto the machine **OR ALTER** the size of the mounting hole - if wheel won't fit the machine, get one that will.
3. **DON'T** ever **EXCEED MAXIMUM OPERATING SPEED** established for the wheel.
4. **DON'T** use mounting flanges on which the bearing surfaces **ARE NOT CLEAN, FLAT AND FREE OF BURNS.**
5. **DON'T TIGHTEN** the mounting nut excessively.
6. **DON'T** grind on the **SIDE OF THE WHEEL** (see Safety Code B7.2 for exception).
7. **DON'T** start the machine until the **WHEEL GUARD IS IN PLACE.**
8. **DON'T JAM** work into the wheel.
9. **DON'T STAND DIRECTLY IN FRONT** of a grinding wheel whenever a grinder is started.
10. **DON'T FORCE GRINDING** so that motor slows noticeably or work gets hot.

AVOID INHALATION OF DUST generated by grinding and cutting operations. Exposure to dust may cause respiratory ailments. Use approved NIOSH or MSHA respirators, safety glasses or face shields, and protective clothing. Provide adequate ventilation to eliminate dust, or to maintain dust level below the Threshold Limit Value for nuisance dust as classified by OSHA.

This machine is intended for grinding the reel of reel type mower units <u>ONLY</u>. Any use other than this may cause personal injury and void the warranty.

To assure the quality and safety of your machine and to maintain the warranty, you MUST use original equipment manufactures replacement parts and have any repair work done by a qualified professional.

ALL operators of this equipment must be thoroughly trained BEFORE operating the equipment.

Do not use compressed air to clean grinding dust from the machine. This dust can cause personal injury as well as damage to the grinder. Machine is for indoor use only. Do not use a power washer to clean the machine.

Low Voltage Relay

The grinder is equipped with a low voltage relay which is factory preset at 100 VAC. If the power supply line does not deliver 100 VAC power under load, the relay will open and trip out the starter. If this occurs, your power supply line is inadequate and must be correct before proceeding further with the grinder.

ADJUSTMENT OF THE LOW VOLTAGE RELAY MAY CAUSE ELECTRICAL COMPONENT FAILURE. ADJUSTMENT OF THE LOW VOLTAGE RELAY WILL VOID ALL ELECTRICAL COMPONENT WARRANTY.

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SPECIFICATIONS

Electrical Requirements ..... 115V 50/60 Hz, 20 amp circuit
Net Weight ..... 2300 lbs [1045 kg]
Shipping Weight ..... 2500 lbs [1140 kg]
Maximum Grinding Length ..... 34 in. [86 cm]

SKILL AND TRAINING REQUIRED FOR SERVICING

This Service Manual is designed for technicians who have the necessary mechanical and electrical knowledge and skills to reliably test and repair the *ACCU*-Master Grinder. For those without that background, service can be arranged through your local distributor.

This Manual presumes that you are already familiar with the normal operation of the Grinder. If not, you should read the Operators Manual, or do the servicing in conjunction with someone who is familiar with its operation.

Persons without the necessary knowledge and skills should not remove the control box cover or attempt any internal troubleshooting, adjustments, or parts replacement.

If you have questions not answered in this manual, please call your distributor. They will contact the manufacturer if necessary.

TORQUE REQUIREMENTS

Throughout this manual we refer to torque requirements as "firmly tighten" or the like. For more specific torque values, refer to the information below.

Bolts Going Into a Nut, or Into a Thread Hole in Steel
Refer to the table at the right.

Bolts Going Into a Thread Hole in Aluminum
Use the Grade 2 values in the table at the right.

Socket-Head Screws Going Into a Nut or Steel
Use the Grade 8 values in the table at the right.

Machine Screws
No. 6 screws: 11 in.-lbs (0.125 kg-m)
No. 8 screws: 20 in.-lbs (0.23 kg-m)
No. 10 screws: 32 in.-lbs (0.37 kg-m)

	GRADE 2 Smooth Head	GRADE 5 3 Marks on Head	GRADE 8 6 Marks on Head
1/4 In. thread	6 ft-lbs (0.8 kg-m)	9 ft-lbs (1.25 kg-m)	13 ft-lbs (1.8 kg-m)
5/16 In. thread	11 ft-lbs (1.5 kg-m)	18 ft-lbs (2.5 kg-m)	28 ft-lbs (3.9 kg-m)
3/8 In. thread	19 ft-lbs (2.6 kg-m)	31 ft-lbs (4.3 kg-m)	46 ft-lbs (6.4 kg-m)
7/16 In. thread	30 ft-lbs (4.1 kg-m)	50 ft-lbs (6.9 kg-m)	75 ft-lbs (10.4 kg-m)
1/2 In. thread	45 ft-lbs (6.2 kg-m)	75 ft-lbs (10.4 kg-m)	115 ft-lbs (15.9 kg-m)

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ASSEMBLY INSTRUCTIONS

Remove the sides, front, and back of the crate. Remove the plastic bag, shrink wrap and bubble wrap around control panel. Remove the metal clips that secure the grinder to the 4 x 6 wood base. With a fork lift, raise the grinder from the wood base and set it in its final position. See FIG. 1 and 2.

THE UNIT WEIGHS 2300 LBS. [1045 kg]. TO LIFT, USE POWER EQUIPMENT.

The Control Panel has a shipping screw and nut installed in its pivot bracket to limit travel during shipping. Remove and discard this screw and nut.

The winch boom is held in place during shipping with a wooden brace. Remove and discard this brace. Remove the shrink wrap that holds the winch trolley to the beam. Remove shipping straps from traverse carriage. Remove window protective sheets.

POSITION BASE

The *ACCU*-Master will require an operating area of about 150" W x 108" D x 87" H [381 x 274 x 221 cm]. The mower reel will be lifted from the front of the machine. The machine operator will operate the unit from this same position. Position the base to allow sufficient operating room in front of the machine. See FIG. 1 and 2.

The base should be placed on a relatively level concrete floor, with ample ceiling height to allow for the installation of the unit. Do not place the unit across two concrete slab seams or across a large crack.

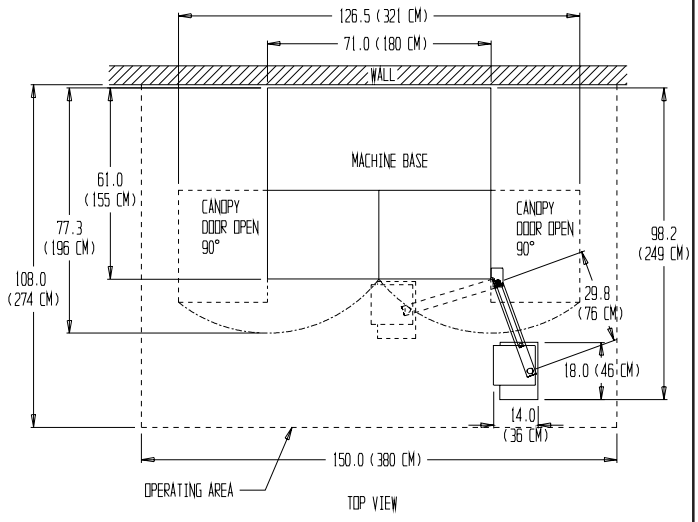


FIG. 1

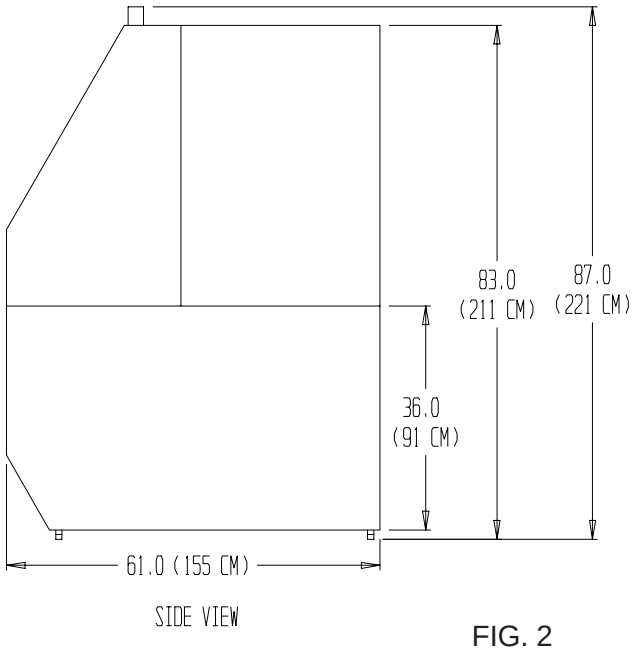
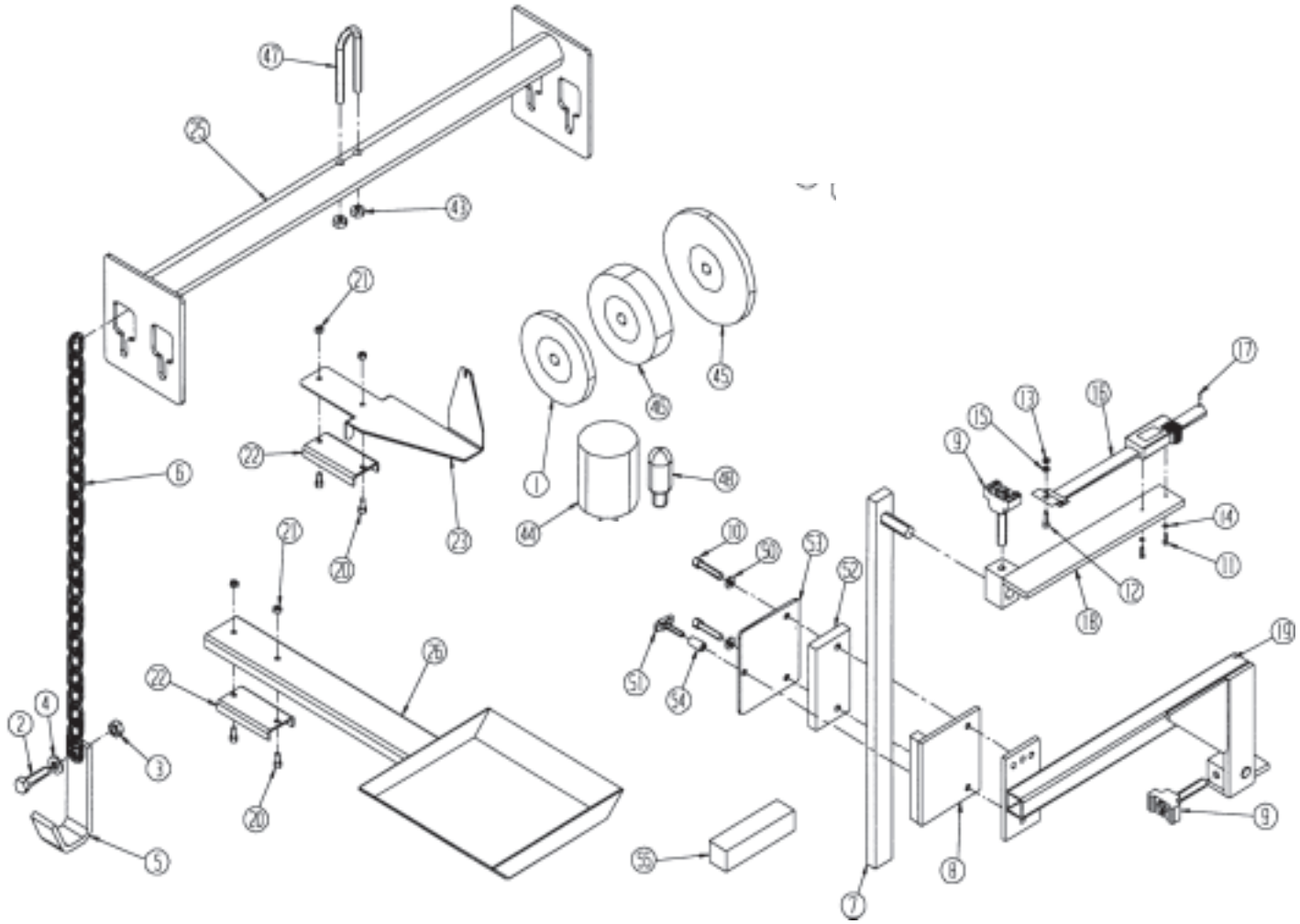


FIG. 2

ASSEMBLY INSTRUCTIONS (Continued)

Remove the carton and remove the contents from the carton onto a workbench. The carton includes:



ASSEMBLY INSTRUCTIONS (Continued)

LEVEL BASE

Each leveling foot has been factory pre-adjusted so it protrudes from the base 2 1/4" [57 mm]. See FIG. 3. Place a level on the top of the table and check the levelness of the unit from side to side. Adjust the leveling feet as necessary to bring to level. See FIG. 4.

Place a level across the table from front to rear. Adjust the leveling feet on the end of the machine as necessary to level. See FIG. 5.

When both front to back and side to side leveling procedures have been completed, thread the hex jam nuts up against the nut that is welded to the bottom until they lock into place. Be careful not to move the leveling feet during this process. See FIG. 3. Make certain that all four leveling feet are firmly contacting the floor.

Recheck with level after locking nuts are firmly tightened.

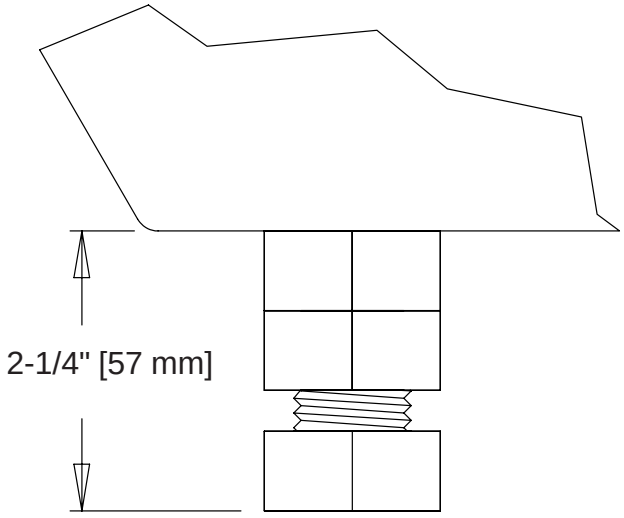


FIG. 3

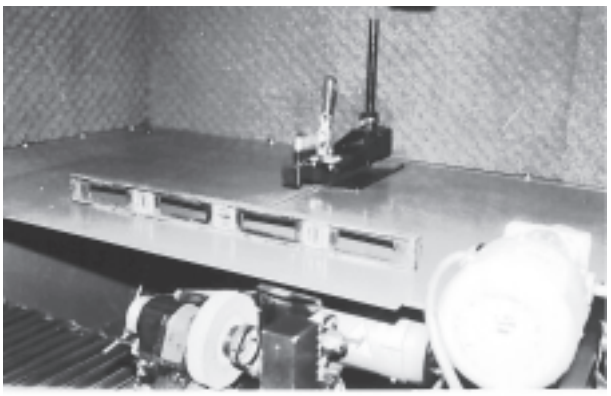


FIG. 4

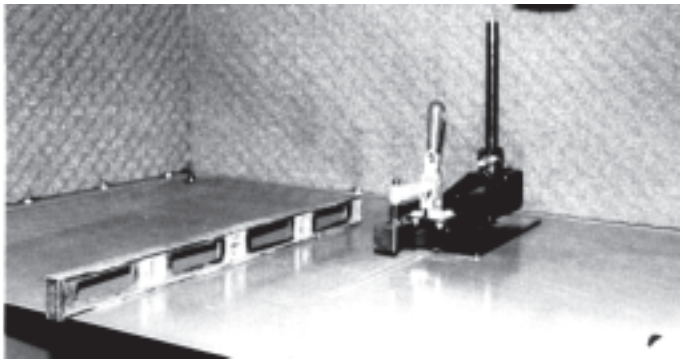


FIG. 5

APPLY POWER

BEFORE YOU APPLY POWER TO THE GRINDER, REFER TO THE "IMPORTANT GROUNDING INSTRUCTIONS" ON PAGE 9.

FIG. 7

115 Volt Model Only. Plug the control box power cord into a standard 115V AC 15-amp grounded receptacle. See FIG. 7.

220 Volt Model Only. For 220 Volt Applications order Part No. 6500951, which includes a prewired 3 KVA 220 V step down to 115 V 50-60 Hz transformer should be ordered..

IT IS RECOMMENDED THAT THIS ACCU-MASTER REEL MOWER GRINDER HAS ITS OWN PERMANENT POWER CONNECTION FROM THE POWER DISTRIBUTION PANEL, WITH NO OTHER MAJOR POWER DRAW EQUIPMENT ON THE SAME LINE.

IT IS REQUIRED THAT THE POWER DELIVERED TO THIS GRINDER IS 115 VAC - 15 AMPS. THE TOLERANCE ON THIS POWER REQUIREMENT IS +/- 5%. THEREFORE THE MINIMUM VOLTAGE REQUIREMENT IS 109VAC WITH 15 AMPS. VOLTAGE MUST BE CHECKED WITH ALL EQUIPMENT UNDER LOAD (OPERATING) ON THE CIRCUIT.

DO NOT OPERATE THIS GRINDER WITH AN EXTENSION CORD.

The grinder is equipped with a low voltage relay which is factory preset at 100 VAC. If the power supply line does not deliver 100 VAC power under load, the relay will open and trip out the starter. If this occurs, your power supply line is inadequate and must be correct before proceeding further with the grinder.

PROPER GROUNDING OF THE RECEP-TACLE GROUND IN YOUR BUILDING MUST BE VERIFIED. IMPROPER GROUNDING IN YOUR BUILDING MAY CAUSE THE GRINDER TO MALFUNCTION.

ADJUSTMENT OF THE LOW VOLTAGE RELAY MAY CAUSE ELECTRICAL COMPONENT FAILURE. ADJUSTMENT OF THE LOW VOLTAGE RELAY WILL VOID ALL ELECTRICAL COMPONENT WARRANTY.

FOR 20 AMP RATED LARGE MACHINES

Below is a list of required wire size in your building.

For 0 to 40 Feet from panel to receptacle = Use 12 Ga. Wire.
For 40 to 60 Feet from panel to receptacle = Use 10 Ga. Wire.
For 60 to 100 Feet from panel to receptacle = Use 8 Ga. Wire.
For 100 to 160 Feet from panel to receptacle = Use 6 Ga. Wire.

For 0 to 12 Meters from panel to receptacle = Use 4.0mm Wire.
For 12 to 18 Meters from panel to receptacle = Use 6.0mm Wire.
For 18 to 30 Meters from panel to receptacle = Use 10.0mm Wire.
For 30 to 48 Meters from panel to receptacle = Use 16.0mm Wire.

ASSEMBLY INSTRUCTIONS (Continued)

For 220 V 50 or 60Hz applications Product No. 6500951 should be ordered.

6500951 includes a 3 KVA 220 Volt Step Down to 115 volt 50/60 Hz transformer which is prewired.

The wiring diagram is shown in FIG. 8.

The power cord has no connector. A connector which is appropriate for your locality and 220 volt, 8 amp application should be installed.

Use only a qualified electrician to complete the installation.

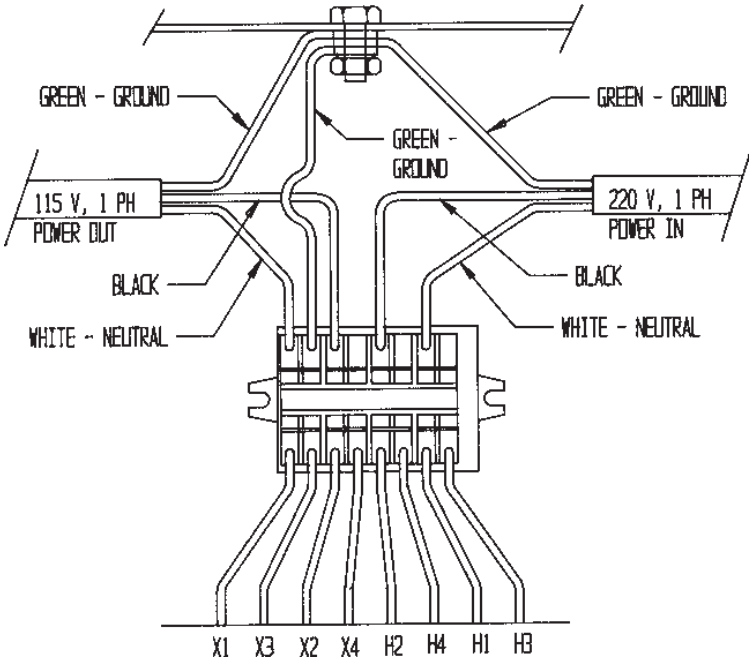


FIG. 8

IMPORTANT GROUNDING INSTRUCTIONS

In case of a malfunction of breakdown, grounding reduces the risk of electrical shock by providing a path of least resistance for electrical current.

This Grinder has an electrical cord with an equipment grounding conductor and a grounding plug. The plug must be plugged into a matching outlet that is properly installed and grounded according to all local or other appropriate electrical codes and ordinances.

Before plugging in the Grinder, make sure it will be connected to a supply circuit protected by a properly-sized circuit breaker or fuse.

Never modify the plug provided with the machine--if it won't fit the outlet, have a proper outlet and circuit installed by a qualified electrician.

ALWAYS PROVIDE A PROPER ELECTRICAL GROUND FOR YOUR MACHINE. AN IMPROPER CONNECTION CAN CAUSE A DANGEROUS ELECTRICAL SHOCK. IF YOU ARE UNSURE OF THE PROPER ELECTRICAL GROUNDING PROCEDURE, CONTACT A QUALIFIED ELECTRICIAN.

PERIODIC MAINTENANCE

INSTALL THE FLASHER LIGHT

Locate flasher assembly in carton. Remove the socket and bulb from the lens. Install lens to the top of the right canopy door using the (2) screws provided with the lens. Attach the ground wire to one of the screws. Clip socket and bulb assembly into lens. See FIG. 7.

CONNECTOR TABS ON SOCKET ARE VERY FRAGILE AND CARE SHOULD BE TAKEN IN ATTACHING WIRES.

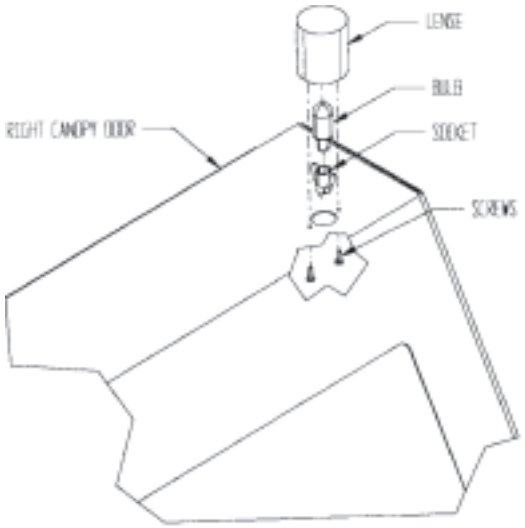


FIG. 7

DAILY MAINTENANCE IS SPECIFIED ON PAGE 4 OF THE OPERATOR'S MANUAL, AND IS TO BE PERFORMED BY THE OPERATOR. LISTED BELOW ARE PERIODIC MAINTENANCE ITEMS TO BE PERFORMED BY YOUR COMPANY'S MAINTENANCE DEPARTMENT:

1. Clean the internal bag and cloth filter in the vacuum system weekly or more often depending on the number of reels ground.

2. Use the grease fitting provided to grease the dovetail with high quality lithium grease monthly. Wipe off excess grease. See FIG. 8.

3. Wipe and re-oil with spray lubricant, the grinding wheel diameter adjusting lead screw every three months. Wipe off all excess lubricant. See FIG. 8.

4. Check the gib adjustment on the grinding wheel diameter adjustment every 3 months. See FIG.8.

5. Inspect the Poly-V belt for cracking and adjust the belt tension per procedure called out in the adjustment section every three months.

6. Wipe and relub with never-seez, the vertical and horizontal alignment shafts and lead screws, every six months. See FIG. 9.

7. Lift the bellows and wipe off the traverse driveshaft and the bearing rails monthly. When a squeaking noise is coming from the actuator bearings, follow the lubrication procedure for actuator and linear bearings. Generally, this will be every six months to a year.

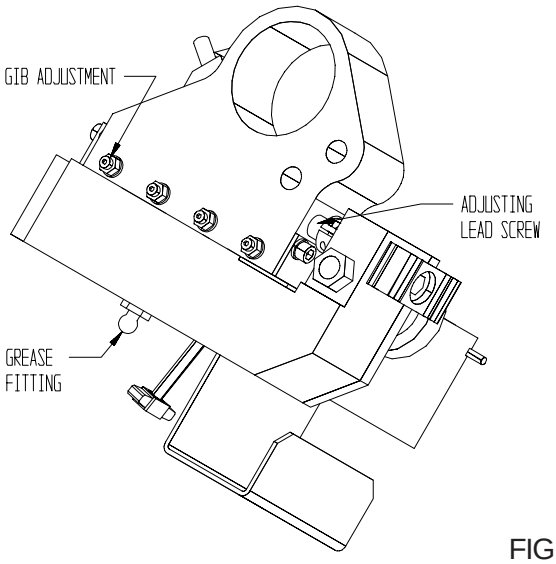


FIG. 8

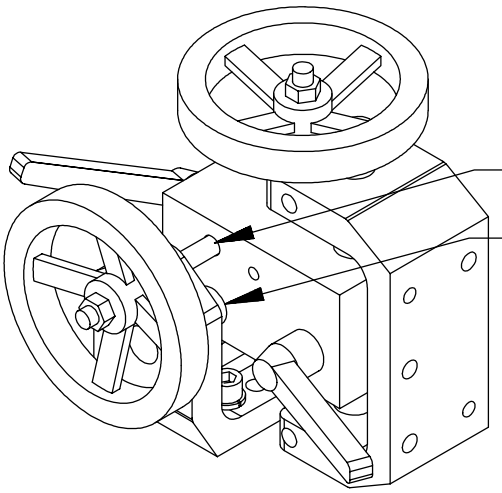


FIG. 9

LUBRICATION

LUBRICATION OF ACTUATOR AND LINEAR BEARINGS

STEP 1--Thoroughly clean all three shafts. See FIG. 10.

STEP 2--Flood spray all three shafts with a spray lubricant *(do not use a teflon based lubricant)* until the lubricant is dripping off the shafts. Then run the carriage back and forth through its range of travel. This will carry the lubricant into the actuator and bearings.

NOTE: Because of the flood of lubricant you may find that the actuator slips and traversing is erratic or stalls. This is not a problem as it will be corrected in the subsequent steps.

STEP 3--With a clean rag, wipe off the excess amount of lubricant from the shafts. Run the carriage back and forth through its range of travel and wipe the shafts after each traverse. Repeat until the shafts are dry to the feel. This completes the lubrication process.

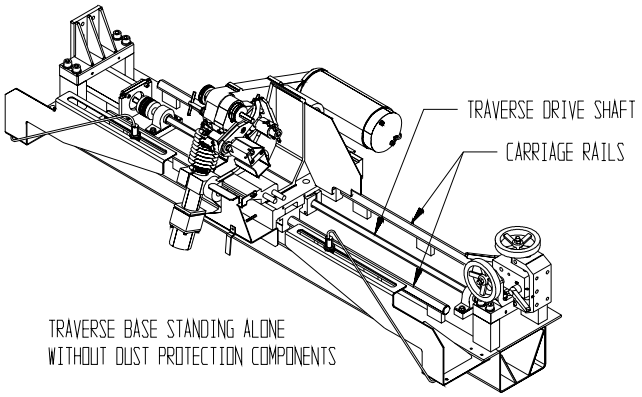


FIG. 10

If the unit will be shut down for an extended period of time, more than four weeks, then the shafts and other appropriate parts of the unit should be flooded with lubricant and that lubricant left in place until the unit is brought back into service. When the unit is brought back into service the full lubrication procedure as stated above should be repeated.

CLEANING AND MAINTENANCE GUIDELINES FOR POLYCARBONATE WINDOWS

Cleaning Instructions

DO NOT USE GASOLINE
Adherence to regular and proper cleaning procedures is recommended to preserve appearance and performance.

Washing to Minimize Scratching

Wash polycarbonate windows with a mild dish washing liquid detergent and lukewarm water, using a clean soft sponge or a soft cloth. Rinse well with clean water. Dry thoroughly with a moist cellulose sponge to prevent water spots. Do not scrub or use brushes on these windows. Also, do not use butyl cellosolve in direct sunlight.

Fresh paint splashes and grease can be removed easily before drying by rubbing lightly with a good grade of VM&P naphtha or isopropyl alcohol. Afterward, a warm final wash should be made, using a mild dish washing liquid detergent solution and ending with a thorough rinsing with clean water.

Minimizing Hairline Scratches

Scratches and minor abrasions can be minimized by using a mild automobile polish. Three such products that tend to polish and fill scratches are Johnson paste Wax, Novus Plastic Polish #1 and #2, and Mirror Glaze plastic polish (M.G. M10). It is suggested that a test be made on a corner of the polycarbonate window with the product selected following the polish manufacturer's instructions.

Some Important "DON'TS"

- **DO NOT** use abrasive or highly alkaline cleaners on the polycarbonate windows.
- **Never** scrape polycarbonate windows with squeegees, razor blades or other sharp instruments.
- Benzene, gasoline, acetone or carbon tetrachloride should **NEVER** be used on polycarbonate windows.
- **DO NOT** clean polycarbonate windows in hot sun or at elevated temperatures.

Graffiti Removal

- Butyl cellosolve, (for removal of paints, marking pen inks, lipstick, etc.)
- The use of masking tape, adhesive tape or lint removal tools works well for lifting off old weathered paints.
- To remove labels, stickers, etc., the use of kerosene, VM&P naphtha or petroleum spirits is generally effective. When the solvent will not penetrate sticker material, apply heat (hair dryer) to soften the adhesive and promote removal.
  GASOLINE SHOULD NOT BE USED!

DIGITAL GAGE

Battery Installation and Origin Setting

- Use only the SR44 button-type silver oxide cell.
- Install the battery with its positive side facing up.

Error Symptoms and Remedies

- **ErrC or display flicker:**
  Occurs when the scale surface is stained. Clean the scale surface and coat a thin film of low-viscosity oil to keep out moisture.
- **E in the least significant digit:**
  This occurs when the slider is moved too quickly, but it does not affect the measurement. If it stays on when the slider stops, the scale surface is probably stained. If this is the case, take remedies as for ErrC.
- **B indication:**
  Battery voltage is low. Replace the battery as soon as possible.

Refer to Operator's Manual page 12, FIG. 7, for digital gage button functions.

ADJUSTMENTS

LINEAR ACTUATOR BEARING REPLACEMENT

NOTE: It is not necessary to remove the linear actuator from the driveshaft--Remove only the bearings.

STEP 1--Remove the shoulder bolt from the top side of carriage. See FIG. 11.

STEP 2--Turn the actuator release lever 1/2 turn clockwise to release the actuator from the drive shaft. Slide the actuator release lever out of actuator bar assembly by loosening the retainer shaft collar, which preloads the holding spring. See FIG. 12.

STEP 3--Move the grinding head carriage to the left side. Lift the bellows. Remove shoulder bolts fastening the six bearings to the actuator body. See FIG 13. Remove the old bearings from the shoulder bolt, and discard, saving the inside washer. Insert the shoulder bolts through the new bearings and the saved inside washers. Then install these assemblies into the actuator body and tighten the shoulder bolts.

STEP 4--Slide the carriage over the actuator assembly to line up the hole in the carriage with the tapped hole in the actuator. Insert the shoulder bolt through self aligning bearings and tighten.

NOTE: Take extra caution not to cross the thread shoulder bolt.

STEP 5--Slide actuator release lever with collar, spring washer and foam seal back into actuator bar assembly and lock in place with retainer shaft collar. See FIG. 12. Turn actuator release lever 1/2 turn counterclockwise to engage bearings to drive shaft.

STEP 6--Using a spring scale, connect the scale to the carriage to pull on the carriage parallel to actuator drive shaft. Then while holding the drive shaft from rotating, pull on carriage; the pull force should be 60 lbs. (See Step 7 for readjustment if necessary.)

THE PULL FORCE IS TO BE CHECKED WHEN SHAFT IS WIPED CLEAN AND DRY. IF CHECKED WHEN OILY, TOO MUCH TENSION WILL BE SET AND AFFECT BEARING LIFE.

STEP 7--If readjustment is required to achieve pull force within specification, with actuator bearings engaged to drive shaft, readjust the two outboard screws with springs that hold the actuator together. See FIG 13. To reach these screws, the actuator bar assembly must be removed. Turn each screw an equal amount when resetting for more or less tension, clockwise is more tension. Repeat Step 6 and verify pull force. Continue to adjust until within specification. The factory preadjusted spring tension is .160 or 5/32" [4 mm] from under the washer holding the spring to the actuator block. See FIG. 12. This should give the 60 lbs. carriage pull force specified.

When adjustment is correct reinstall the actuator bar assembly. The bar assembly must be adjusted parallel to the actuator aluminum body and so it is just touching the outboard screw heads. Then tighten the lock nut on the lower actuator bar assembly mounting screw. See FIG. 12. Then reinstall the release lever package as above.

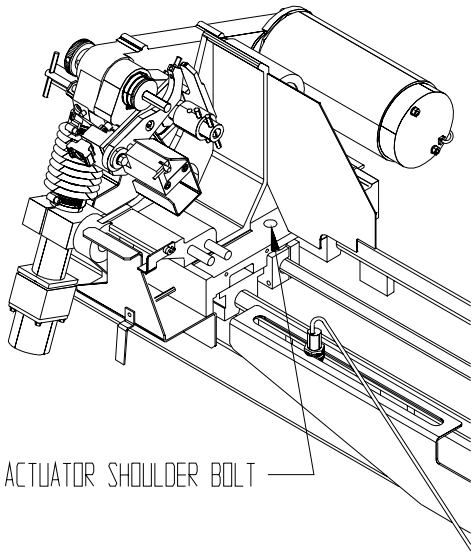


FIG. 11

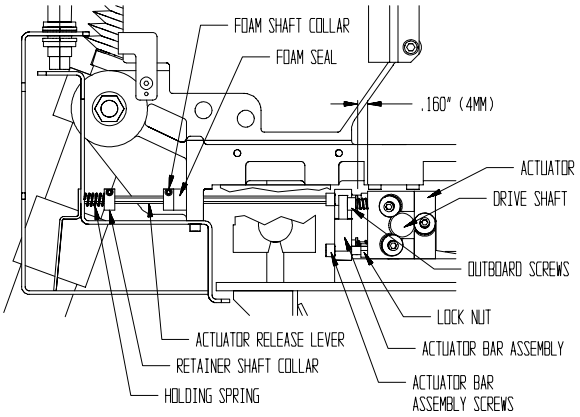


FIG. 12

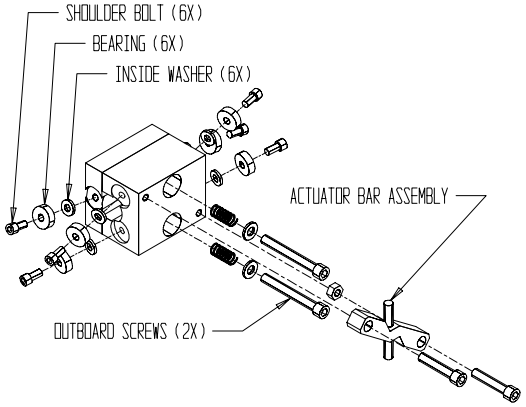


FIG. 13

ADJUSTMENTS (Continued)

CARRIAGE LINEAR BEARING REPLACEMENT

STEP 1--Detach the bellows mounting brackets from the carriage. Detach front and rear shields. See FIG. 15.
STEP 2--Remove the three screws of one linear bearing and slide the linear bearing off the end of the carriage shaft.
STEP 3--Insert a new linear bearing onto the end of the carriage shaft with the tension adjustment screw pointing outward. See FIG. 14. Adjust the tension screw of the linear bearing so when you radially rotate the linear bearing around the carriage shaft there should be no free play between the linear bearing and the carriage shaft.
NOTE: Tension is too tight if you feel a cogging action when you rotate linear bearing around the shaft. This cogging is from the skidding of the bearing on the shaft and indicates tension screw is too tight.

Finally, sliding the bearing block back and forth should be a smooth uniform motion.

SETTING THE BEARING TENSION CORRECTLY IS CRITICAL TO PROPER GRINDING. BEARINGS WHICH ARE TOO TIGHT OR TOO LOOSE WILL CAUSE POOR GRIND QUALITY. ALSO, BEARINGS WHICH ARE TOO TIGHT WILL HAVE SUBSTANTIALLY SHORTER LIVES AND MAY DAMAGE THE SHAFT.

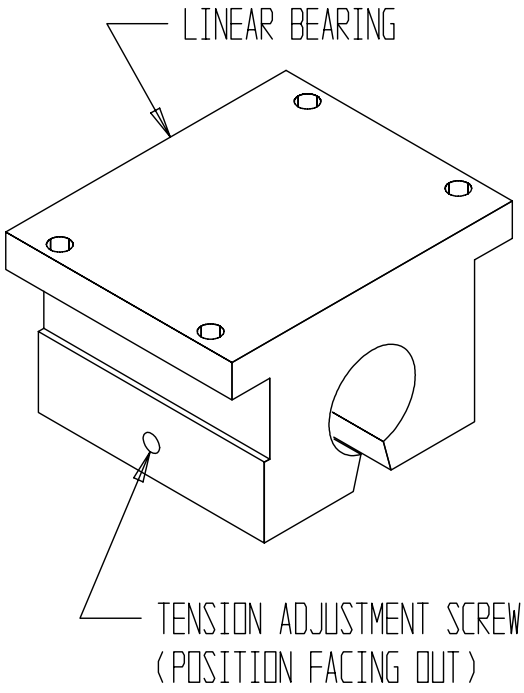


FIG. 14

STEP 4--Slide linear bearing under carriage and attach with the three screws.
NOTE: Repeat Steps 2 thru 4 with the other three linear bearings.
STEP 5--After all four linear bearings are reattached to the carriage check for correct bearing tension. The bearing tension is correct when you try to lift the carriage and can feel no carriage movement, which is free play up and down. The most dependable method of checking free play is to use a magnetic base dial indicator attached to the traverse frame weldment and reading the vertical movement above each bearing. This movement should be within .001" [.03 mm] Also, when pulling the carriage in the traversing direction, there should be only approximately a 3 lb force, with the actuator disengaged, using a scale system similar to Step 6 of Linear Actuator Bearing Replacement Section in this manual. To double check the assembly, slide the carriage assembly from "end of travel" to "end of travel", it should have very uniform resistance through the full range of travel.
STEP 6--Replace the bellows carriage mounting brackets onto the carriage. Replace front and rear shields. See FIG. 15.

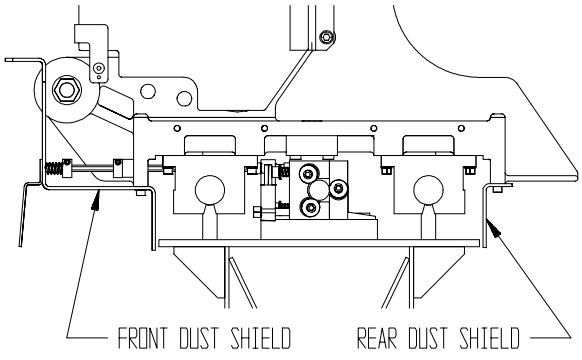


FIG. 15

ADJUSTMENTS (Continued)

REEL FINGER DOVETAIL GIB AND ADJUSTING KNOB ADJUSTMENTS

The reel finger slide to the reel finger positioner has a dovetail with an adjustable gib for tensioning. Tighten the gib set screws on the side so there is no free play in the dovetail slide. Check for movement when pushing on the relief finger side to side with a 20 lbs. (44 kg) force. Make sure the knob assembly for adjusting the relief finger to the grinding wheel is rotatable by hand. The gib adjustment should be sufficient to maintain a rigid position of the reel finger. See FIG. 16.

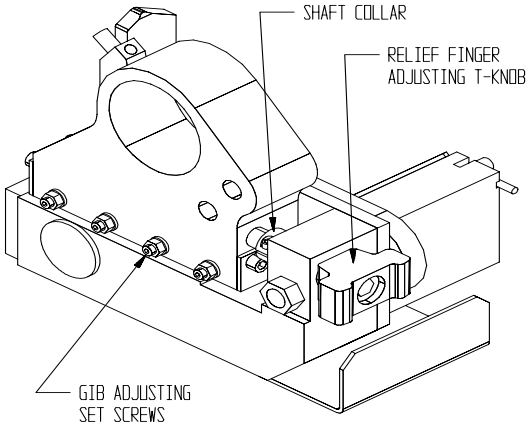


FIG. 16

Check the knob assembly rotating tension by checking the tightness of the nylon plug to the knob assembly threads. The tightness has to be sufficient so the knob assembly does not rotate during the relief grinding cycle. See FIG. 17. NOTE: To adjust the nylon plug you must lock the index finger assembly down and then adjust the reel finger positioner so the clearance holes line up with the nylon plug set screw.

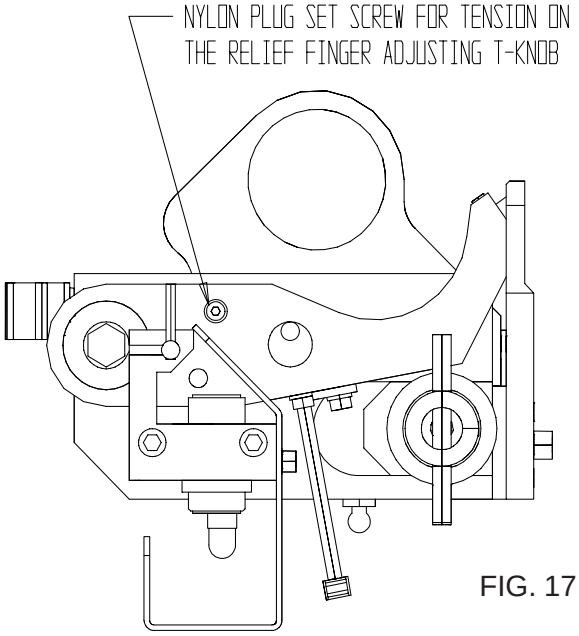


FIG. 17

Take up any free play between the tee knob assembly, reel finger slide and .375 threaded split shaft collar. Loosen the shaft collar locking cap screw and rotate the shaft collar until there is no end play. Retighten locking cap screw on the threaded split shaft collar. See FIG. 16.

GRINDING HEAD BELT TENSION ADJUSTMENT

The grip grinding wheel knob need not be removed for belt tensioning adjustment. Remove the six socket head cap screws holding the vacuum hose bracket, the two double tube clamps and the belt cover. For grinding motor belt adjustment, loosen the four socket head cap screws that attach the motor. Adjust the grinding motor for proper belt tension and tighten the four socket head cap screws.
The proper belt tension for the grinding head is to push down on the poly V belt half way between to two pulleys with 5 lbs. [2 kg] of force and belt movement dimensions to be .12 inches [3 mm]. See FIG. 18.
To verify belt tension mount the belt guard with two screws. Turn the motor on. If the belt is tensioned correctly, start-up torque of the motor through the pulley to the belt should have zero slippage. If there is belt slippage when turning on the motor there will be a slight squeal before the belt comes up to speed. When you achieve correct tension, reassemble all of the remaining parts that have been removed.

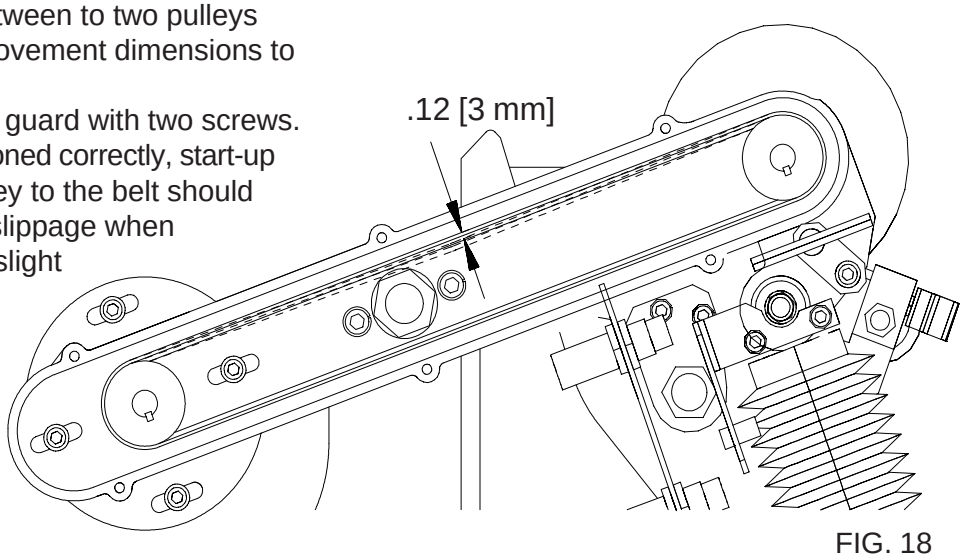


FIG. 18

ADJUSTMENTS (Continued)

INDEX FINGER PROXIMITY SETTING

Set all motor switches to the off position.

Put the grind selector switch in the jog cycle.

Press the machine system start switch, so the grinder is operational.

Push down on the index finger until the stop pin is within .06 inches (1.5 mm) of bottoming out. (You can use a 1/16" gage pin or rod stock between the stop pin and index finger). Set the proximity switch to activate the light at this setting. This assures the index finger to be close to its final stop position so the reel is completely indexed before the carriage starts to traverse. See FIG. 19.

The spring load force pushing up on the index finger brings it away from the proximity when released.

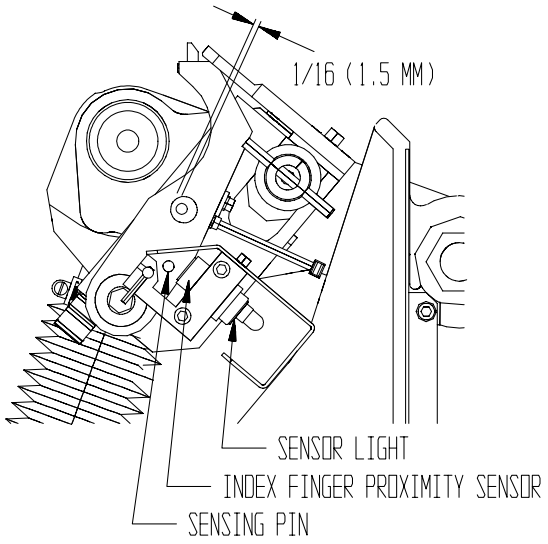
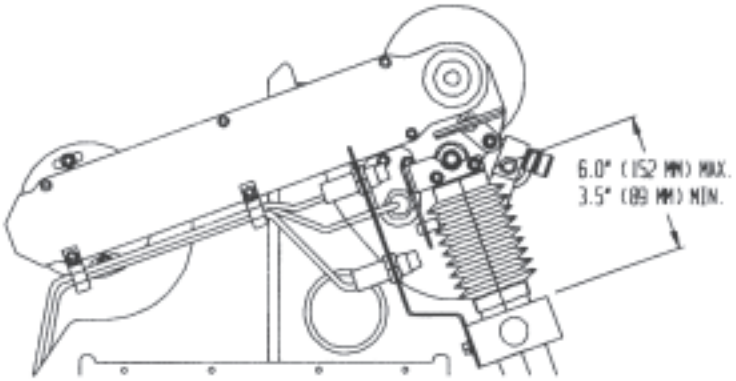


FIG. 19

STEPPPER INFEED TRAVEL LIMITS

The infeed stepper maximum extension is 6.0" (152 mm) abd minimum compression is 3.5" (89 mm). If you experience a situation where the grind does not properly finish, checkthat you have not exceeded stepper travel by checking the values per FIG. 20.



LOCKING INDEX FINGER PIN

To align the Index Finger Locking Pin to the hole in the Index Finger Assembly loosen the two socket head cap screws so the index sensor block is movable. Push down on the index finger assembly until the spring loaded index finger locks into hole with no binding. Tighten the two socket head cap screws so the index sensor block is secured, and the locking pin moves freely. See FIG. 21.

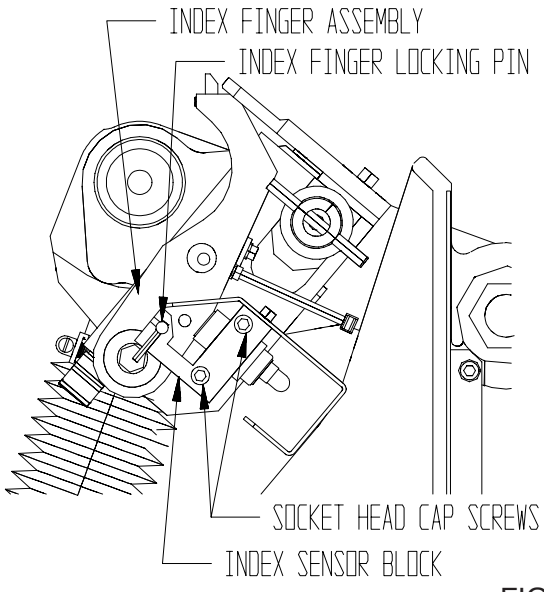


FIG. 21

ADJUSTMENTS (Continued)

PROXIMITY SWITCH

For the proximity switch to perform properly and reverse the direction of the carriage at each end of the rails, a distance of 3/16" [4 mm] to 1/4" [6 mm] needs to be maintained between the carriage proximity flag bracket and the proximity switch. See FIG. 22.

NOTE: Light on proximity activates when metal crosses over the switch.

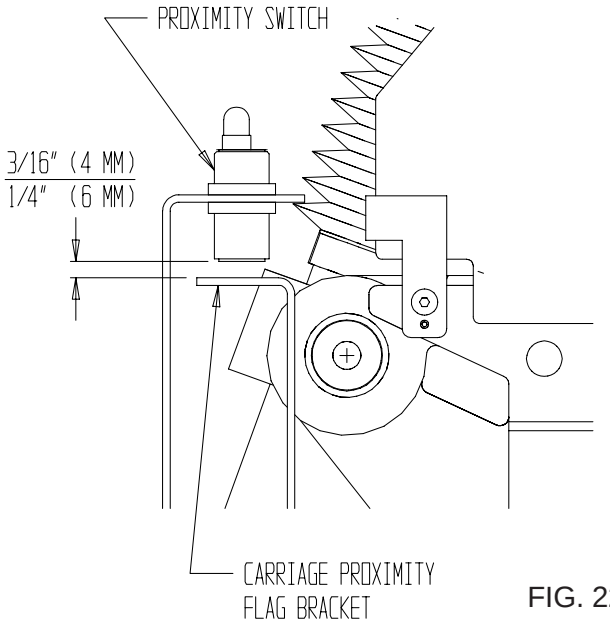


FIG. 22

ADJUSTABLE RELIEF TENSION

If the relief angle appears to vary during relief grinding adjust the tension on the nylon plug and set screw. See FIG. 22A.

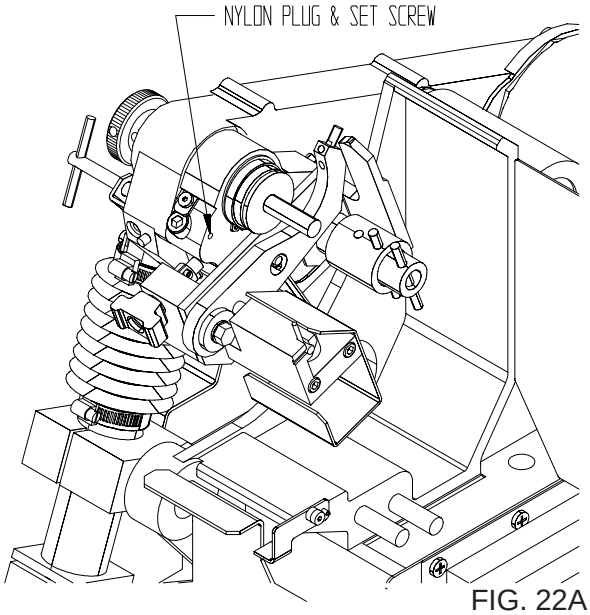


FIG. 22A

FREQUENT OVERLOADING AND CIRCUIT TRIPPING

The magnetic starter is factory set at a 12 AMP rating. See FIG. 23.

If your magnetic starter is frequently shutting down, contact your distributor.

The main control power source is for a 20 AMP supply circuit. See machine setup section for explanation.

NOTE: Manual/Auto Selector is factory set at manual mode.

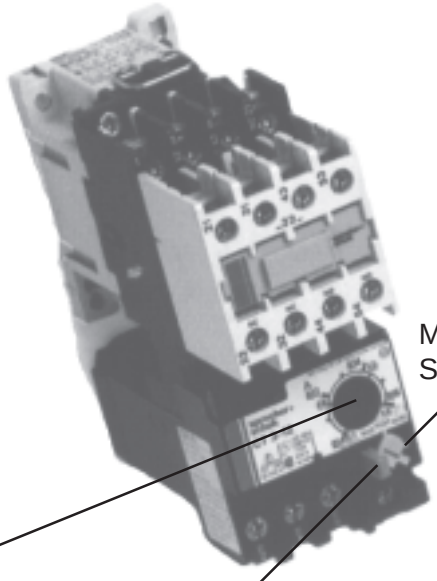


FIG. 23

ADJUSTMENTS (Continued)

SPIN GRINDING ATTACHMENT ADJUSTMENT

If play develops so crank handle wants to rotate in the scissor action on the spin grinding attachment, the play can be eliminated by tightening the set screw identified in FIG. 24.

If there is too much play in the spin drive pivot points, torque down the hex nut tight so conical washer is compressed, then back off 1/2 turn. See FIG. 24.

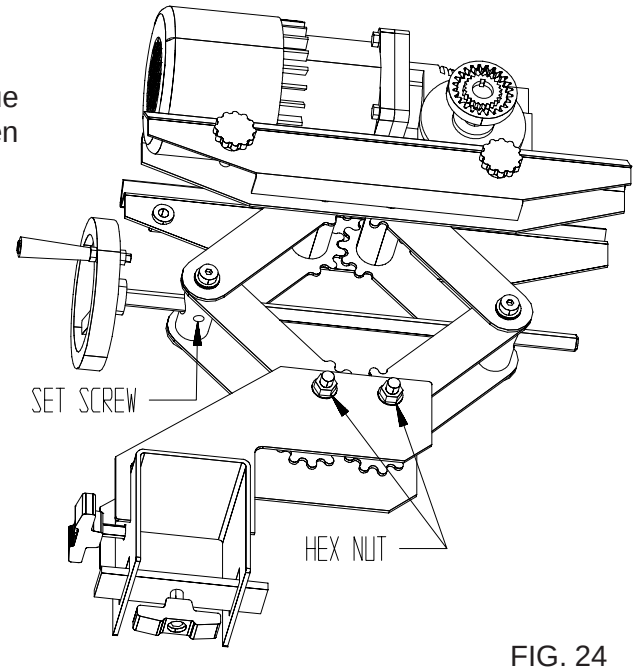


FIG. 24

TRAVERSE MOTOR COUPLING

Traverse motor shaft must be concentric to traverse drive shaft within .010. The traverse shaft and motor shaft are to have at least 1/8" [3 mm] to 1/2" [13 mm] clearance so they do not contact each other. The coupling is to be locked down tightly with the spiral grooves equally spaced for the full length. See FIG. 25.

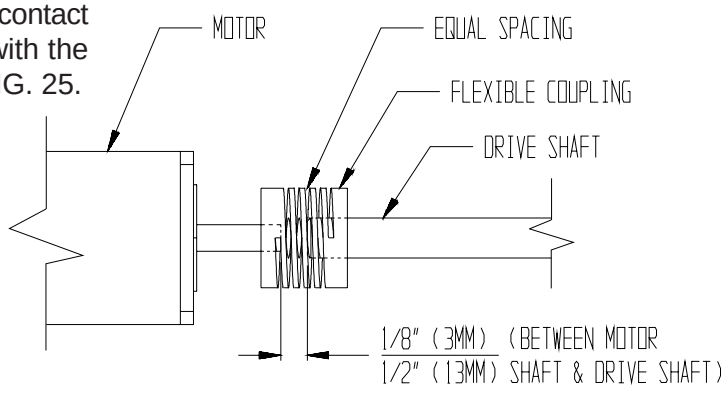


FIG. 25

CONTROL BOARD POTENTIOMETER ADJUSTMENTS

TRAVERSE DRIVE CONTROL BOARD (TDC)

The Traverse Drive Control Board has two potentiometers on the board as shown on drawing 6504342 which is included. Both of the potentiometers are set to the full counterclockwise (CCW) position and should be left there. No adjustments are required.

INPUT/OUTPUT CONTROL BOARD (IOC)

The Input/Output Control Board has two potentiometers on the board as shown on drawing 6504342 which is included. These potentiometers have been set at the factory to the position shown on the drawing. Also see FIG. 26.

SPIN DRIVE CONTROL BOARD (SDC)

The Spin Drive Control Board has three potentiometers on the board as shown on drawing 6504342 which is included. These potentiometers have been set at the factory to the positions shown on the drawing. Also see FIG. 27

In the Relief Grinding Mode---
The Relief Speed Pot (RSP) and the Relief Torque Pot (RTP) interact with each other. The (RSP) is located on the (IOC) Input Output Controller as Pot 1 preset at 9:00 (20 Volts DC). The (RTP) is located on the control panel and is for relief torque adjustment. See FIG. 26.

Relief Speed Pot (RSP) when rotated clockwise will increase maximum spin drive speed. This speed should never be above the 9:30 setting.

Relief Torque Pot (RTP) can vary the reel to finger holding torque for relief grinding. The recommended starting point is 30 in/lbs of torque setting. Never adjust the (RTP) potentiometer dial past the red line marking. Setting the reel to finger torque to high could cause the traverse motor system to not operating smoothly.

In the Spin Grinding Mode---
the Spin Torque Potentiometer (STP) and the Spin Speed Pot (SSP) interact with each other. The (STP) is located on the (IOC) Input Output Controller as Pot 2 preset at 1:30 for torque setting. The (SSP) is located on the control panel and is for spin speed adjustment. See FIG. 26.

Spin Torque Pot (STP) controls maximum torque allowable in the spin grind cycle only. This should never be adjusted past the 2:30 position. Check the reel spin torque by hand spinning the reel first to check that it is free turning.

The Spin Speed Pot (SSP) controls reel spin speed, adjust as required. This controls the spin drive speed for spinning the reel.

POTENTIOMETERS ON THE SPIN DRIVE CONTROL (SDC) See FIG. 27.

Maximum Speed Pot---
The maximum speed is factory preset to 4:30 (fully clockwise) to allow for maximum spin speed.

Minimum Speed Pot---
The minimum speed is factory preset at 8:30 (full counterclockwise) so zero speed is obtainable for spin speed.

IR Compensation Pot---
The IR Compensation is factory set at 9:00.

Regulation of the spin or relief grind spin motor may be improved by a slight adjustment of the IR COMP trim pot clockwise from its factory-set position. Overcompensation causes the motor to oscillate or to increase speed when fully loaded. If you reach such a point, turn the IR COMP trim pot counterclockwise until the symptoms just disappear.

CONTROL BOARD POTENTIOMETER ADJUSTMENTS (Continued)

GRINDING MOTOR CONTROL BOARD (GMC)

The Grinding Motor Control Board has four potentiometers on the board as shown on drawing 6504342 which is included. These potentiometers have been set at the factory to the positions shown on the drawing. See FIG. 28.

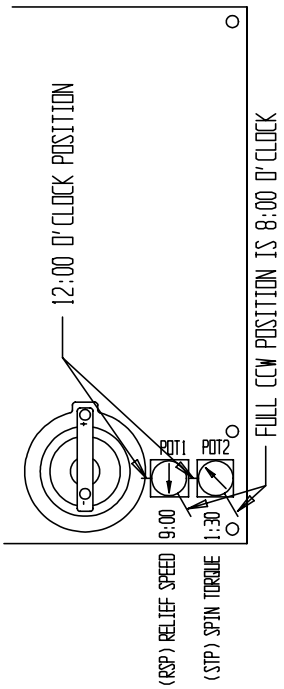


FIG. 26

Maximum Speed---
The maximum speed potentiometer is preset to 1:00 position for 90 Volts DC to the grinding motor for 4300 RPM. The 4300 RPM is for optimum grinding wheel operating speed. DO NOT go above the 4300 RPM.
Check for 90 Volts DC on Grinding Motor Control (GMC) at Term A1 to Term A2.

Minimum Speed---
The minimum speed is set full counterclockwise so it is non-functional for this application.

Current Limit---
The current limit is preset at 3:00 at the factory. The red light above the current limit indicates when the grinding motor is above the preset current limit. This is a visual indicator to check while in a grinding cycle. Going above the current limit causes the motor to pulsate. The current limit can be turned clockwise to increase the motor's maximum torque for grinding overloads. The 10 amp circuit breaker on the control panel will trip if the overload persists for a prolonged period of time. Use a lower grinding head traverse speed if nuisance tripping is experienced.

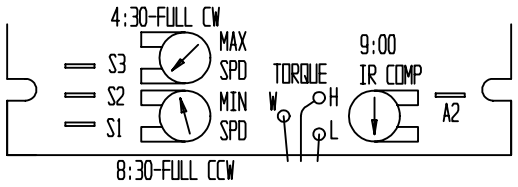


FIG. 27

IR Compensation---
Regulation of the grinder motor may be improved by slight adjustment of the IR COMP trim pot clockwise from its factory-set position. Overcompensation causes the motor to oscillate or to increase speed when fully loaded. If you reach such a point, turn the IR COMP trim pot counterclockwise until the symptoms just disappear.

The control is preset to 9:00 position. Never adjust past the 11:00 position when changing the setting to increase higher torque for heavy grinding.

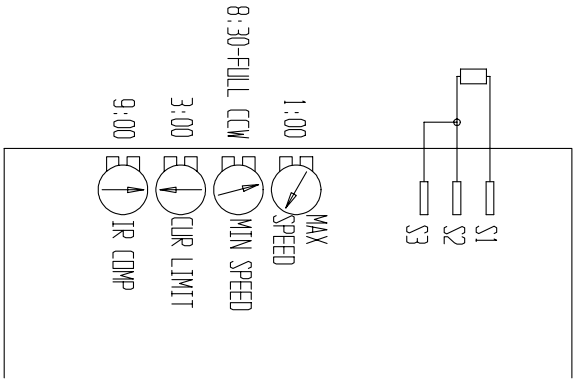


FIG. 28

E-PROM REPLACEMENT

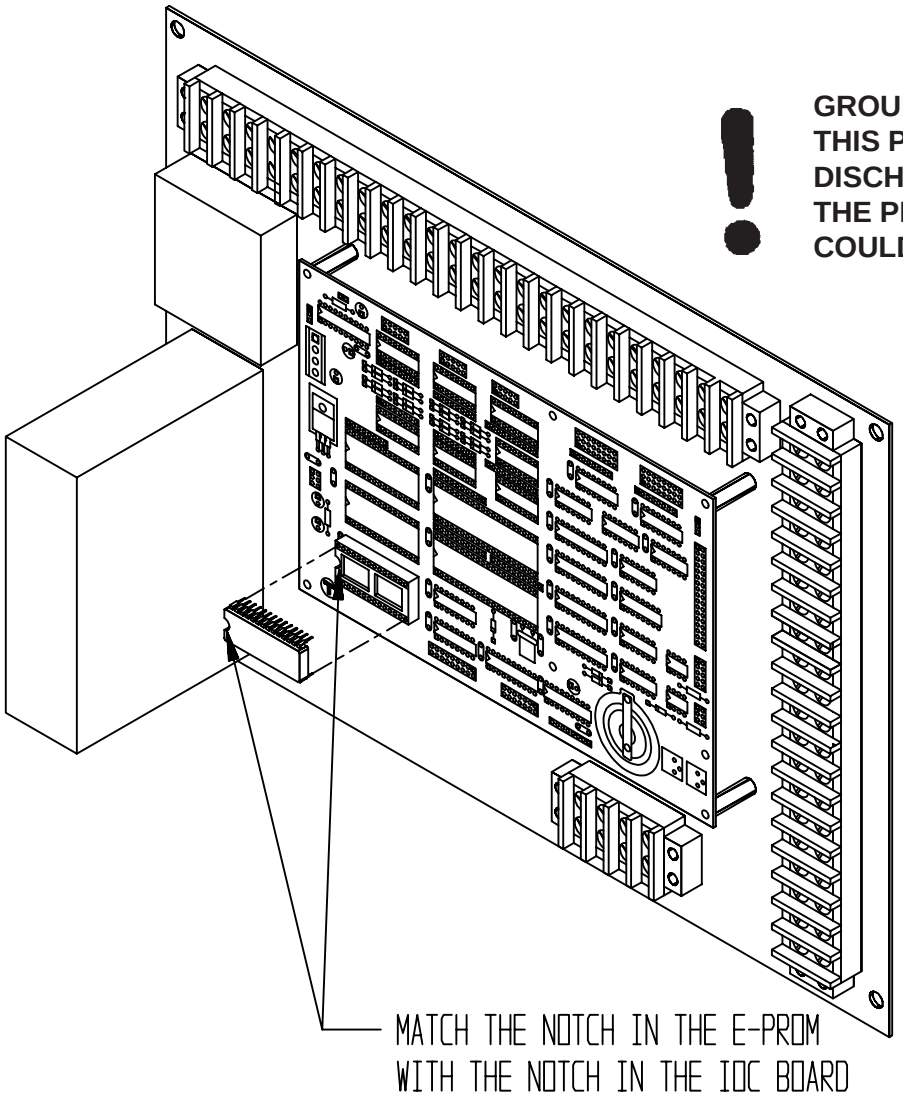
The E-Prom is electrically programmable so replacement is required for a program change. The E-Prom is located on the (IOC) Input Output Controller on the lower left hand corner at location #U5. See FIG. 29. All E-Proms have software revision level and are dated. NOTE: The "V" notch at one end of the E-Prom is always at the left hand side when mounted on the Input Output Controller Board (IOC).

For replacement of the E-Prom use a special puller or a small .12" [3 mm] wide single blade screw driver. Use a grounding strap or ground yourself with one hand on a machine ground screw. Pry the E-Prom off evenly, going from end to end, between the underside of E-Prom and the top of the base mount.

Take the new E-Prom and make sure each row of pins are in a uniform line and 90 degrees to the top face. The pins are usually less than 90 degrees and to change the angle lay the pins on the rubbermat on the control panel. Rotate so the pins are approximately 90 degrees. Do this to both sides. Make certain to remain grounded during this procedure.

The E-Prom is now ready to insert. Again make certain that the "V" notch at the end of the E-Prom is to the left side. Place the bottom pins in the lower row first and rotate up into position so the top row of pins are guided in. Press both ends in evenly until seated.

GROUNDING IS CRITICAL IN THIS PROCEDURE. IF A STATIC DISCHARGE OCCURS DURING THE PROCEDURE, THE E-PROM COULD BE DAMAGED.



GROUNDING IS CRITICAL IN THIS PROCEDURE. IF A STATIC DISCHARGE OCCURS DURING THE PROCEDURE, THE E-PROM COULD BE DAMAGED.

FIG. 29

MACHINE SERVICE (Continued)

GRINDING HEAD ASSEMBLY

Remove grinding wheel and grinding wheel knob. The Grinding Head Spindle Assembly consists of the grinding head spindle and a ball bearing press fit together. The other ball bearing is slip fit on the opposite end during assembly with loctite on the bearing bore. To replace the spindle assembly remove the grinding wheel grip knob, square key and belt cover. See FIG. 30. Loosen the 4 socket head cap screws on the motor to remove the poly-V belt. Loosen the 2 set screws on the spindle pulley and remove the pulley, square key and pulley spacer. Push on the right hand side of the spindle assembly to compress conical washers so there is no pressure on the shaft retaining ring and to expose the retaining ring for removal. Using a retaining ring pliers remove the small retaining ring from the spindle assembly. You can now remove the spindle assembly out the right side by lightly tapping on the left end with a rubber mallet. The second ball bearing can be removed from the belt side of the Grinding Head Housing.

To reassemble place the 4 conical washers (2 pair nested and then place the 2 pairs back to back) against the ball bearing on the new spindle assembly. See FIG. 31. Slide this assembly into the Grinding Head Housing and slip fit the new second ball bearing onto the spindle assembly and into grinding head housing (apply loctite #242 to the bore of the bearing before assembling). Using a C-clamp compress the conical washers so you can replace the retaining ring. The retaining ring is fragile and easily damaged when removing. Always use a new retaining ring when reassembling the grinding head spindle. Only open the retaining ring enough to install. Opening the ring excessively will damage the retaining ring, making is unusable.

Replace the pulley spacer and mount the square key positioned tight against the pulley spacer. Remount the pulley pushing against the pulley spacer and bottom out against the snap ring with no end play. Next tighten the two pulley set screws. Then remount the poly-V belt. (See Grinding Head Belt Tension Adjustment in the adjusting section). Replace belt cover and square key and mount the grinding wheel grip knob and tighten the two set screws.

THE RETAINING RING IS FRAGILE AND EASILY DAMAGED WHEN REMOVING. ALWAYS USE A NEW RETAINING RING WHEN REASSEMBLING THE GRINDING HEAD SPINDLE. ONLY OPEN THE RETAINING RING ENOUGH THE INSTALL. OPENING THE RING EXCESSIVELY WILL DAMAGE THE RETAINIG RING, MAKING IT UNUSABLE.

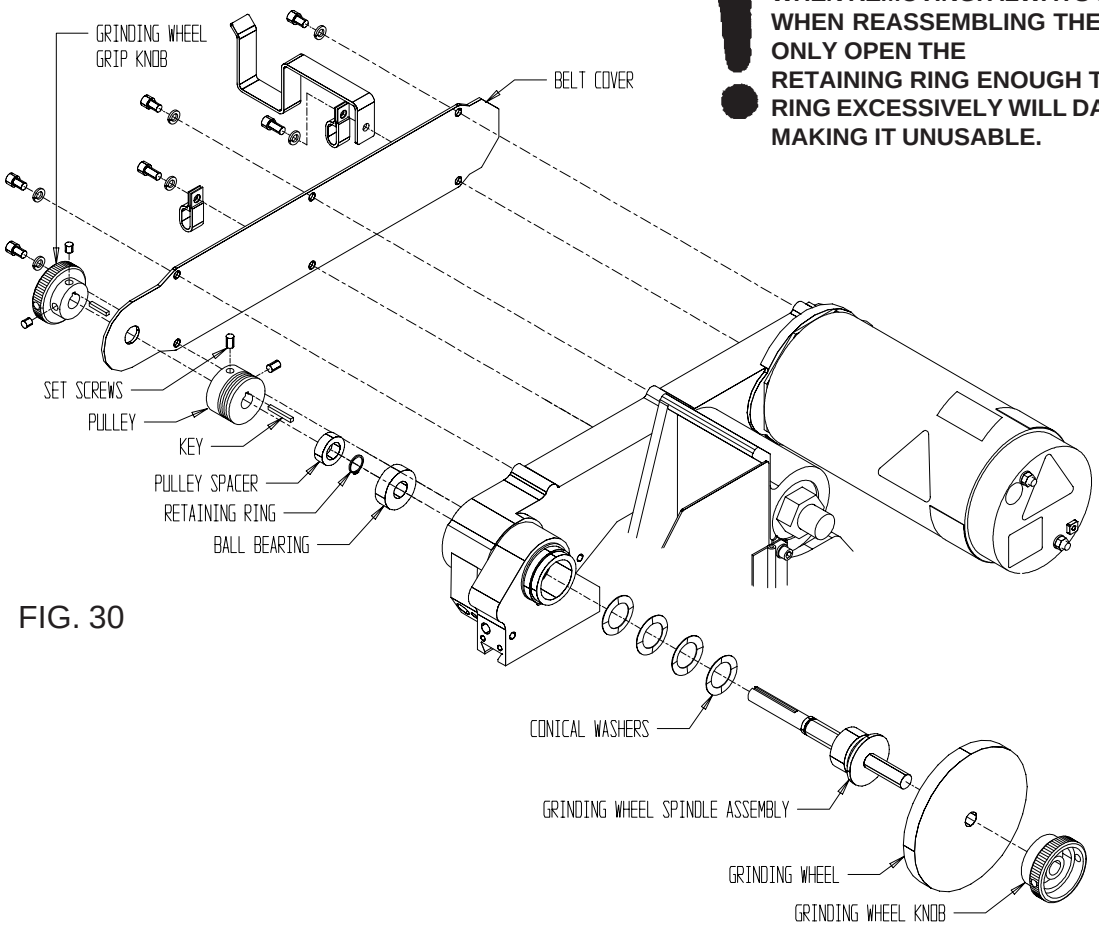


FIG. 30

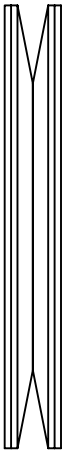


FIG. 31

ELECTRICAL TROUBLESHOOTING

SKILL AND TRAINING REQUIRED FOR ELECTRICAL SERVICING

This Electrical Troubleshooting section is designed for technicians who have the necessary electrical knowledge and skills to reliably test and repair the *ACCU*-Master electrical system. For those without that background, service can be arranged through your local distributor.

This manual presumes that you are already familiar with the normal operation of the Grinder. If not, you should read the Operators Manual, or do the servicing in conjunction with someone who is familiar with its operation.

Persons without the necessary knowledge and skills should not remove the control box cover or attempt any internal troubleshooting, adjustments, or parts replacement.

If you have any question not answered in this manual, please call your distributor. They will contact the manufacturer if necessary.

WIRE LABELS

All wires on the ACCU-Master have a wire label at each end for troubleshooting. The wire label has a code which tells you wiring information. The wire label has a seven position code. The first two digits are the wire number: 01-99. The next three numbers or letters are the code for the component to which the wire attaches. Example: IOC for Input/Output Controller. The last two numbers or letters are the number of the terminal on the component to which the wire attaches.

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AC Main Power Controls ..... Page 27-28
Machine Light ..... Page 29

MANUAL CYCLE
Spin Drive Controls in Spin Mode ..... Page 30-32
Spin Drive Controls in Relief Mode ..... Page 33-35
Grinding Motor Controls ..... Page 36-37
Dust Collector Controls ..... Page 38-39
Winch Controls ..... Page 40

Traverse Drive Controls--w/prox ..... Page 41-43
Traverse--stopping and reversing ..... Page 44
Stepper Infeed Controls--w/prox ..... Page 45-47
No Manual (jog) Cycle--no (LCD) Liquid Crystal Display ..... Page 48-49
No Manual (jog) Cycle--because of system error messages ..... Page 50-51

AUTO CYCLE
No Spin Auto Cycle--because of system error messages ..... Page 52-53
No Relief Auto Cycle--because of system error messages ..... Page 54-56
No Automatic Cycle ..... Page 57
Flashing Light ..... Page 58

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--AC Main Power Controls: no electrical power to control panel.

In your Product Packet Assembly, there are a series of prints. Find the print titled AC Power Controls and Junction Box/Light Assembly, before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire terminals with approximately 3 lbs force to verify there are no loose terminal connections and/or no loose crimps between wire and terminal. If loose terminals are found, retighten and retest system. If problem persists, test as listed below.

Possible Cause	Checkout Procedure	
You must push the System Start Switch (SSS) for power to control Panel	**A.** Listen for the Magnetic Starter (MAG) Contacts to pull in with a clunk	Machine works Yes--end troubleshooting No--go to Step **B.** next
Main Power Cord is not plugged in	**B.** Plug in main power cord	Machine works Yes--end troubleshooting No--go to Step **C.** next
Main 20 amp outlet circuit breaker has tripped	**C.** Check circuit breaker and reset if necessary. (Check wall outlet with a light to make sure it works)	Machine works Yes--end troubleshooting No--but light works in outlet--go to Step **D.** next No--but light does not work in outlet. You must solve your power delivery problem independent of machine.
No 115 Volts AC power to (MAG)	**D.** Check for incoming power (MAG) for 115 Volts AC	(MAG) L1 black wire to L2 white wire 115 Volts AC Yes--go to Step **F.** next No--go to Step **E.** next
No power from junction box	**E.** At rear junction box Wire Block 2 (WB2) check for 115 Volts AC	(WB2) Across main power cord #02 white wire to #02 black wire for 115 Volts AC Yes--replace panel power cord #05 No--replace main power cord #02
No 115 Volts AC power out of (MAG)	**F.** Check for 115 Volts AC going out	(MAG) Term #T1 to T3 for 115 Volts AC Yes--go to Step **L.** next No--go to Step **G.** next
(MAG) not working	**G.** Push reset button on top of (MAG) Ref: Factory set for 12 amp	This may have been tripped from either a motor overload condition or during machine shipment. Push (SSS). If machine works-- Yes--end troubleshooting No--go to Step **H.** next
	H. Contractor coil chatters when (MAG) is powered up. Tighten terminals T1, T2, & T3 that connect the overload and contactor together	Bad contacts in contactor cause it not to hold in when turned on. If machine works Yes--end troubleshooting No--go to Step **I.** next

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
115V power not delivered to (MAG) coil	**I.** Check at Magnetic Starter coil for 115 Volts AC with main electrical power on and pushing (SSS)	(MAG) Term #A1 to A2 for 115 Volts AC Yes--replace magnetic starter No--go to Step **J.** next
Bad wires for power to (SSS)	**J.** Check wire continuity with machine power off	Verify continuity across (ESS) Term #1 to #2 to be "0" ohms reading. (SSS) Term #3 to (MAG) L1 this check wires #49 and #99. "0" ohms mean wires are good Yes--go to step **K.** next No--replace wires #49 & #99
	K. Check wire continuity with machine power off	(MAG) Term A2 to (MAG) L2 this checks wires #53 & 54. "0" ohm reading means wires are good. Yes--go to Step **M.** next No--replace wires 53, and 54
Wire Block 1 (WB1) 115 Volts AC verified	**L.** Check for 115 Volts AC at (WB1)	(WB1) white wire #56 to black wire #57 for 115 Volts AC Yes--end troubleshooting No--replace wires #56 & #57
Bad wires for power to Emercency Stop Switch (ESS) or (SSS)	**M.** Check wire continuity with machine power off	(SSS) Term #4 to (MAG) #14 for wires #50 & 52 and separately check (ESS) Term #2 to (MAG) #13 wire #51. "0" ohms means the wire is good Yes--go to Step **N.** next No--replace wires #50, 51 & 52
(ESS) is bad	**N.** Check for 115 Volts AC across normally open contacts of (ESS)	(ESS) Term #1 to #2 for 115 Volts AC Yes--go to Step **O.** next No--replace (ESS)
(SSS) is bad	**O.** Check for 115 Volts AC across (SSS) contacts when machine power is on and (SSS) has not been pushed. Check for 0 Volts AC across (SSS) contacts when pushing on (SSS)	(SSS) Term #3 to #4 for 115 Volts AC (SSS) not pushed. Term #3 to #4 "0" Volts AC (SSS) pushed. Yes--replace (MAG) No--replace (SSS)

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--Machine light is not working

Assuming AC main power cord wire #2 has 115 Volts AC at (WB2) Wire Block 2.

In your Product Packet Assembly, there are a series of prints. Find the print titled <u>Junction Box and Light Assembly,</u> before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire terminals with approximately 3 lbs force to verify there are no loose terminal connections and/or loose crimps between wire and terminals. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

Possible Cause	Checkout Procedure	
Light switches are not turned on or there is a bad bulb	**A.** Turn on machine light toggle switch on lamp holder. Check the light bulb in another light fixture or replace with a new bulb. Next turn on light switch electrical junction cover switch	Light works Yes--end troubleshooting No--go to Step **B.** next
Wire cord is bad	**B.** Remove cover of light junction box check for 115 Volts AC	Check for 115 Volts AC across light cord white wire #03 to switch black wire #03 Yes--go to Step **C.** next No--replace light cord wire #03
Switch or machine light is bad	**C.** Check for 115 Volts AC across machine light assembly	Check for 115 Volts AC across machine black wire #10 to white wire #10 Yes--replace machine light assembly* No--replace switch assembly

*NOTE: Again we want to remind, that there is a switch at the back of the machine light assembly, which must be turned on for the light to work.

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--Spin Drive not working in (manual) jog mode and in spin mode.

Assuming (SSS) System Start Switch is on and (AMS) Auto/Manual Switch is in (manual) jog with 115 Volts AC to control panel and all other manual (jog) mode functions are working.

In your Product Packet Assembly, there are a series of prints. Find the print titled Spin Drive Controls before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire terminals with approximately 3 lbs force to verify there are no loose terminal connections and/or loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

Possible Cause	Checkout Procedure	
Spin Speed Pot (SSP) set to zero	**A.** Set (SSP) to 200 on the control panel.	Spin Motor works Yes--end troubleshooting No--go to Step **B.** next
Spin Motor Switch (SMS) or Spin Rotation Switch (SRS) are not on	**B.** Turn (SMS) switch on. Turn (SRS) switch to direction of reel rotation required. NOTE: center position is off.	Spin Motor works Yes--end troubleshooting No--go to Step **C.** next
Circuit Breaker 2 (CB2) is tripped (4amp)	**C.** Reset circuit breaker switch (tripped by current overload) Check that reel is free spinning	Spin Motor works Yes--end troubleshooting No--go to step **D.** next
Spin Motor Switch (SMS) is not working	**D.** Check for (SMS) incoming 115 Volts AC	(SMS) Term #1 to #2 for 115 Volts AC Yes--go to step **E.** next No--go to Step **F.** next
	E. Check for (SMS) output of 115 Volts AC	(SMS) Term #5 to #6 for 115 Volts AC Yes--got to Step **K.** next No--replace (SMS) switch
Relay 1 (RE1) is not working	**F.** Check for (RE1) input of 0 Volts DC at the coil. Reminder, must be in manual (jog) mode.	(RE1) Term 0 to term 1 for 0 Volts DC Yes--go to Step **H.** next No--If 24 Volts DC go to Step **G.** next
Input Output Control (IOC) is not working	**G.** Check output 6 grinding/spin motor output to (RE1)	(IOC) Term 32 to 22 for 0 VDC No--reads 24 Volts replace (IOC)
(RE1) contacts are not working	**H.** Check for (RE1) output of 115 Volts AC	(RE1) Term 7 (black wire) to (WB1) Wire Block 1 (white wire) #78 for 115 Volts AC Yes--replace wires #98 & #78 No--go to step **I.** next
	I. Check for (RE1) input of 115 Volts AC	(RE1) Term 8 (black wire) to (WB1) Wire Block 1 (white wire) #78 for 115 Volts AC Yes--replace (RE1) No--go to Step **J.** next

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
(CB2) is not working (4 amp)	**J.** Check for (CB2) normally closed contacts	(WB1) Wire Block 1 (white wire) #78 to (CB2) (black wire) #58 for 115 Volts AC Yes--replace (CB2) and wire #70 No--replace wire #58
Spin Rotation Switch (SRS) is not working	**K.** Check for (SRS) input of 115 Volts AC	(SRS) Term 5 to term 8 for 115 Volts AC Yes-- go to Step **L.** next No--replace wire 77 & 79
	L. Check for (SRS) output of 115 Volts AC NOTE: Check spin rotation switch in both positions.	(SRS) Term 1 to term 4 for 115 Volts AC Yes--go to Step **M.** next No--replace (SRS) switch
Spin Drive Control (SDS) is not working.	**M.** Check (SDC) L1 to L2 for 115 Volts AC	(SDC) Term L1 to term L2 for 115 Volts AC Yes--go to Step **N.** next No--replace wires 82 & 83
	N. Check (SDC) A1 & A2 for (SSP) approx 90 Volts DC (Have Spin Speed Pot set to 400 RPM)	(SDC) Term A1 to A2 for approx 90 Volts DC Yes--go to Step **O.** next No--got to Step **R.** next
	O. Check for approx 90 Volts DC input to (SRS)	(SRS) Term 6 to 7 for approx 90 Volts DC Yes--go to Step **P.** next No--replace wires 80 & 81
	P. Check for approx 90 Volts DC output to (SRS)	(SRS) Term 2 to 3 for approx 90 Volts DC Yes--go to Step **Q.** next No--replace (SRS) switch
Spin Drive motor is bad	**Q.** Check spin motor continuity	Remove wires at (SRS) Term 2 & 3 check 0 ohms across the black and white wires Yes--end troubleshooting No--go to Step **U.** next
Spin Speed Pot (SSP) is not working	**R.** (SSP) (10K) on control panel	Input/Output Controller (IOC) Pin #36 to 41 Pot Full CCW Pot Full CW 0 Volts DC 4.21 Volts DC (IOC) Pin #36 to 43 Pot Full CCW Pot Full CW 4.21 Volts DC 0 Volts DC Yes--go to Step **S.** next No--go to Step **U.** next
Input/Output Control (IOC) board is not working	**S.** Check (IOC) output to the Spin Board.	Input/OUtput Controller (IOC) Pin #33 to Pin #41 Pot Full CCW Pot Full CW 0 Volts DC. 4.21 volts DC (IOC) Pin #33 to Pin #43 Pot Full CCW Pot Full CW 4.21 volts DC 0 Volts DC Yes--Go to Step **T.** No--Replace (IOC)

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
Spin Torque Pot (STP) is not working	**T.** (STP) (50K) on (IOC) as pot 2 (preset at 1:30)	(IOC) Pin #40 to 44 .14 Volts DC (IOC) Pin #40 to 46 .06 Volts DC Yes--replace (SDC) No--replace (IOC)
(SSP) is not working	**U.** (SSP) (10K) Remove 3 wires red wire to term #36 (IOC) white wire to term #41 (IOC) black wire to term #43 (IOC)	Check for 10,000 ohms Red wire to white wire Full CCW--0 ohms Full CW--10,000 ohms Red Wire to black wire Full CCW--10,000 ohms Full CW--0 ohms Yes--replace (IOC) No--replace (SSP)
Worn Motor Brushes	**V.** Inspect Motor Brushes	Remove the brushes one at a time and maintain orientation for reinsertion. See if brush is worn short 3/8" [10 mm] minimum length. Yes--replace motor brushes. No--replace Spin Drive Motor

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--Spin Drive not working in (manual) jog mode and in relief mode.

Assuming (SSS) System Start Switch is on and (AMS) Auto Manual Switch is in (manual) jog with 115 Volts AC to control panel and all other manual (jog) mode functions are working.

In your Product Packet Assembly, there are a series of prints. Find the print titled Spin Drive Controls before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire terminals with approximately 3 lbs force to verify there are no loose terminal connections and/or no loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

Possible Cause	Checkout Procedure	
Relief Torque Pot (RTP) set to zero	**A.** Set (RTP) to 20 on the control panel	Spin Motor works Yes--end troubleshooting No--go to Step **B.** next
Spin Motor Switch (SMS) or Spin Rotation Switch (SRS) are not on.	**B.** Turn (SMS) switch on. Turn (SRS) switch to direction of reel rotation required. NOTE: center position is off.	Spin Motor works Yes--end troubleshooting No--go to Step **C.** next
Circuit Breaker 2 (CB2) is tripped (4amp)	**C.** Reset circuit breaker switch (tripped by current overload) Check that reel is free spinning	Spin Motor works Yes--end troubleshooting No--go to step **D.** next
(SMS) is not working	**D.** Check for (SMS) incoming 115 Volts AC	(SMS) Term #1 to #2 for 115 Volts AC Yes--go to step **E.** next No--go to Step **F.** next
	E. Check for (SMS) output of 115 Volts AC	(SMS) Term #5 to #6 for 115 Volts AC Yes--got to Step **K.** next No--replace (SMS) switch
Relay 1 (RE1) is not working	**F.** Check for (RE1) input of 0 Volts DC at the coil. Reminder, must be in manual (jog) mode	(RE1) Term 0 to term 1 for 0 Volts DC Yes--go to Step **H.** next No--If 24 Volts DC go to Step **G.** next
Input Output Control (IOC) is not working	**G.** Output 6 grinding/spin motor output to (RE1) coil	(IOC) Term 32 to 22 for 0 VDC No--reads 24 Volts, replace (IOC)
(RE1) contacts are not working	**H.** Check for (RE1) output of 115 Volts AC	(RE1) Term 7 (black wire) to (WB1) Wire Block 1 (white wire) #78 for 115 Volts AC Yes--replace wires #98 & #78 No--go to step **I.** next
	I. Check for (RE1) input to (SRS) of 115 Volts AC	(RE1) Term 8 (black wire) to (WB1) Wire Block 1 (white wire) #78 for 115 Volts AC Yes--replace (RE1) Relay 1 No--go to Step **J.** next

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
(CB2) is not working (4 amp)	**J.** Check for (CB2) normally closed contacts	(WB1) Wire Block 1 (white wire) #78 to (CB2) (black wire) #58 for 115 Volts AC Yes--replace (CB2) and wire #70 No--replace wire #58
(SRS) is not working	**K.** Check for (SRS) input of 115 Volts AC	(SRS) Term 5 to term 8 for 115 Volts AC Yes-- go to Step **L.** next No--replace wire 77 & 79
	L. Check for (SRS) output of 115 Volts AC NOTE: Check spin rotation switch in both positions	(SRS) Term 1 to term 4 for 115 Volts AC Yes--go to Step **M.** next No--replace (SRS) switch
Spin Drive Control (SDC) is not working.	**M.** Check (SDC) L1 to L2 for 115 Volts AC	(SDC) Term L1 to term L2 for 115 Volts AC Yes--go to Step **N.** next No--replace wires 82 & 83
	N. Check (SDC) A1 & A2 for approx 12 Volts DC. Have Relief Torque Pot (RTP) set to red line.	(SDC) Term A1 to A2 for approx 12 Volts DC Yes--go to Step **O.** next No--got to Step **R.** next
	O. Check (SRS) for approx 12 Volts DC input	(SRS) Term 6 to 7 for approx 12 Volts DC Yes--go to Step **P.** next No--replace wires 80 & 81
	P. Check (SRS) for approx 12 Volts DC output	(SRS) Term 2 to 3 for approx 12 Volts DC Yes--go to Step **Q.** next No--replace (SRS) switch
Spin Drive motor is bad	**Q.** Check spin motor continuity	Remove wire at (SRS) Term #2 & 3 for 0 ohms across the black and white wires Yes--Spin Motor should operate, if not, go to step **U.** next No--go to step **U.** next
(RTP) Relief Torque Pot is not working	**R.** Check (RTP) (50K) on control panel (check voltage with pots at fully clockwise and counterclockwise positions)	(IOC) Pin #38 to 44 Pot CCW Pot CW 0 Volts DC .21 Volts DC (IOC) #38 to 46 Pot CCW Pot CW .21 Volts DC 0 Volts DC Yes--go to Step **S.** next No--go to Step **T.** next
Input/Output Controller (IOC) board not working	S. Check (IOC) output to the spin board.	Input/outpust Controller (IOC) Pin #37 to Pin #44 Pot CCW Pot CW OVolts DC .21 Volts DC (IOC) PIn #37 to Pin #46 Pot CCw Pot CW .21 Volts DC 0 volts DC Yes--Go to Step T. next No Replace (IOC)

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
Relief Speed Pot (RSP) is not working	**T.** Check (RSP) (10K) on (IOC) as pot 1 (this is preset to 9:00)	(IOC) Pin #34 to 41 .7 VDC (IOC) Pin #34 to 43 3.5 VDC Yes--replace (SDC) No--replace(IOC)
(RTP) is not working	**U.** (RTP) (50K) Remove 3 wires red wire to term #38 (IOC) white wire to term #44 (IOC) black wire to term #46 (IOC)	Check for 50,000 ohms Red wire to white wire Full CCW--0 ohms Full CW--50,000 ohms Red Wire to black wire Full CCW--50,000 ohms Full CW--0 ohms Yes--Replace (IOC) No--replace (RTP)
Worn Motor Brushes	**V.** Inspect Motor Brushes	Remove the brushes one at a time and maintain orientation for reinsertion. See if brush is worn short 3/8" [10 mm] minimum length Yes--replace motor brushes. No--replace Spin Drive Motor

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--Grinding motor not working in (manual) jog mode.

Assuming (SSS) System Start Switch is on and (AMS) Auto/Manual Switch is in (manual) jog with 115 Volts AC to control panel and all other manual (jog) mode functions are working.

In your Product Packet Assembly there are a series of prints. Find the print titled Grinding Motor Controls, before starting the troubleshooting below. Verify all wires shown in the drawing are correct and pull on wire terminals with approximately 3 lbs force to verify there are no loose terminal connections and/or loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

Possible Cause	Checkout Procedure	
Grinding Motor Switch (GMS) is not on	**A.** Turn switch on	Grinding Motor works Yes--end troubleshooting No--go to Step **B.** next
Circuit Breaker (CB1) 1 is tripped	**B.** Reset circuit breaker switch (tripped by current overload)	Grinding Motor works Yes--end troubleshooting No--go to step **C.** next
(GMS) is not working	**C.** Check for (GMS) incoming 115 Volts AC	(GMS) Term #1 to #2 for 115 Volts AC Yes--go to step **D.** next No--go to Step **E.** next
	D. Check for (GMS) going out at 115 Volts AC	(GMS) Term #5 to #6 for 115 Volts AC Yes--go to Step **J.** next No--replace (GMS)
Relay 1 (RE1) is not working	**E.** Check for (RE1) input of 0 Volts DC at the coil. Reminder, must be in manual (jog) mode	(RE1) Term 0 to term 1 for 0 Volts DC Yes--go to Step **G.** next No--If 24 Volts DC go to Step **F.** next
Input Output Control (IOC) is not working	**F.** Output 6 grinding/spin motor output to (RE1) coil	(IOC) Term 32 to 22 for 0 VDC No--reads 24 Volts replace (IOC)
(RE1) contacts are not working	**G.** Check for (RE1) output of 115 Volts AC	(RE1) Term 4 (black wire) to (WB1) Wire Block 1 (white wire) #78 for 115 Volts AC Yes--replace wires #89 & #78 No--go to step **H.** next
	H. Check for (RE1) input of 115 Volts AC to contacts	(RE1) Term 3 (black wire) to (WB1) Wire Block 1 (white wire) #78 for 115 Volts AC Yes--replace (RE1) Relay 1 No--go to Step **I.** next

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
(CB1) is not working	**I.** Check for (CB1) normally closed contacts (10 amp)	(WB1) Wire Block 1 (white wire) #78 to (CB1) (black wire) #58 for 115 Volts AC Yes--replace (CB1) circuit breaker 1 and wire #69 No--replace wire #58
Filter (FTR) is not working	**J.** Check line side of filter for input of 115 Volts AC	(FTR) wire #87 to #88 for 115 Volts AC Yes-- go to Step **K.** next No--replace wires #87 & #88
	K. Check load side of filter for output of 115 Volts AC	(FTR) Wire #61 to #62 for 115 Volts AC Yes--go to Step **L.** next No--replace (FTR)
Grinding Motor Control (GMC) is not working (remove cover over the control board)	**L.** Check (GMC) for input voltage of 115 Volts AC	(GMC) Term L1 to L2 for 115 Volts AC Yes--go to Step **M.** next No--replace wires #61 & #62
	M. Check (GMC) resistor assy wire connections	(GMC) term #S1, S2, & S3 for loose wires Yes--replace resistor assembly No--go to Step **N.** next
	N. Check (GMC) output voltage of 90 Volts DC to motor	(GMC) term #A1 to A2 for 90 +/- 5 Volts DC Yes-- go to Step **O.** next ** No--if 0 V replace (GMC)
Grinding Head DC Motor cord is bad (remove back cover to motor)	**O.** Check grinding motor cord #01	At DC motor check term #A1 to #A2 for 90 Volts DC Yes--go to Step **P.** next No--replace grinding motor cord #1
Grinding Motor is bad	**P.** Check grinding motor continuity	Remove wires at terminal A1 and A2 at motor. Check for 0 ohms across terminals A1 and A2. Yes--end troubleshooting No--go to Step **Q.** next
Worn Motor Brushes	**Q.** Inspect Motor Brushes	Remove the brushes one at a time and maintain orientation for reinsertion. See if brush is worn short 9/16" [14 mm] minimum length. Yes--replace motor brushes. No--replace Spin Drive Motor

**NOTE: If voltage checks less than 90 VDC, but not 0 VDC, then adjust MAX SPEED POT on the (GMC) until you read 90 VDC. If you cannot achieve 90 VDC, replace the (GMC).

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--Dust Collector not working in (manual) jog mode.

Assuming (SSS) System Start Switch is on and (AMS) Auto/Manual Switch is in (manual) jog with 115 Volts AC to control panel and all other manual (jog) mode functions are working.

In your Product Packet Assembly, there are a series of prints. Find the print titled <u>Dust Collector Controls</u> and <u>Junction Box and Light Assembly</u> before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire terminals with approximately 3 lbs force to verify there are no loose terminal connections and/or no loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problems persists, test as listed below.

Possible Cause	Checkout Procedure	
Dust Collector Switch (DCS) is not on	**A.** Turn switch on	Dust Collector works-- Yes--end troubleshooting No--go to Step **B.** next
Circuit Breaker 6 (CB6) is tripped (10 amp) (See rear junction box)	**B.** Reset circuit breaker switch (tripped by current overload)	Dust Collector works-- Yes--end troubleshooting No--go to step **C.** next
(DCS) is not working	**C.** Check for (DCS) output of 115 Volts AC	(DCS) Term #1 to #2 for 115 Volts AC-- Yes--go to step **J.** next No--go to Step **D.** next
	D. Check for (DCS) incoming of 115 Volts AC	(DCS) Term #5 to #6 for 115 Volts AC Yes--replace (DCS) No--go to Step **E.** next
Relay 1 (RE1) is not working	**E.** Check for (RE1) input of 0 Volts DC at the coil. Reminder, must be in manual (jog) mode	(RE1) Term 0 to term 1 for 0 Volts DC Yes--go to Step **G.** next No--If 24 Volts DC go to Step **F.** next
Input Output Control (IOC) is not working	**F.** Output 6 grinding/spin motor output to (RE1) coil	(IOC) Term 32 to 22 0 VDC No--reads 24 Volts replace (IOC)
(RE1) contacts are not working	**G.** Check for (RE1) output of 115 Volts AC	(RE1) Term 7 (black wire) to (WB1) Wire Block 1 (white wire) #78 for 115 Volts AC Yes--replace wires #98 & #78 No--go to step **H.** next
	H. Check for (RE1) input of 115 Volts AC to contacts	(RE1) Term 8 (black wire) to (WB1) Wire Block 1 (white wire) #78 for 115 Volts AC Yes--replace (RE1) No--go to Step **I.** next

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
Circuit Breaker 2 (CB2) is not working (4 amp)	**I.** Check for (CB2) normally closed contacts	(WB1) Wire Block 1 (white wire) #78 to (CB2) (black wire) #58 for 115 Volts AC Yes--replace (CB2) and wire #70 No--replace wire #58
Relay 3 (RE3) is not working	**J.** Check for (RE3) input of 115 Volts AC at coil	(RE3) Term 0 to term 1 for 115 Volts AC Yes-- go to Step **K.** next No--replace VAC relay cord #4
	K. Check for (RE3) input of 115 Volts AC at contacts	(RE3) Term 8 to term 4 for 115 Volts AC Yes--go to Step **L.** next No--go the step **M.** next
	L. Check for (RE3) output of 115 Volts AC at contacts	(RE3) Term 6 to term 2 for 115 Volts AC Yes--replace vacuum motor No--replace (RE3)
(CB6) is not working (10 amp)	**M.** Check for (CB6) normally closed contacts	(WB2) Wire Block 1 (white wire) #48 to (CB6) (black wire) #46 for 115 Volts AC Yes--replace (CB6)and wire #46 No--replace wire #48

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--Winch does not work in either direction.

In your Product Packet Assembly, there are a series of prints. Find the print titled <u>Junction Box and Light Assembly</u> before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire terminals with approximately 3 lbs force to verify there are no loose terminal connections and/or loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

Possible Cause	Checkout Procedure	
7 amp circuit breaker on winch motor is tripped	**A.** Reason: Check for a lifting overload condition or wiring shorted to ground. Reset breaker located at end of winch motor.	Winch works-- Yes--end troubleshooting No--go to Step **B.** next
No voltage to motor	**B.** Check that motor coil cord from DC motor is plugged in	Winch works-- Yes--end troubleshooting No--go to Step **C.** next
	C. Check for 115 Volts AC at the plug end winch cord wire #6 by plugging in a hand drill	Drill works-- Yes--replace winch No-- go to Step **D.** next
	D. Check for main power cord #2 is plugged in to outlet	Winch works-- Yes--end troubleshooting No--go to Step **E.** next
	E. Check connections inside rear junction box on (WB2) Wire Block 2 from main power cord.	(WB2) 115 Volts AC check black side to white side wires Yes--replace cord #6 No--replace cord #2

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--Traverse Drive not working in (manual) jog mode

Assuming (SSS) System Start Switch is on and (AMS) Auto/Manual Switch is in (manual) jog with 115 Volts AC to control panel and all other manual (jog) mode functions are working.

In your Product Packet Assembly, there are a series of prints. Find the print titled Traverse Drive Controls, before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire terminals with approximately 3 lbs force to verify there are no loose terminal connections and/or loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

Possible Cause	Checkout Procedure	
Traverse Overload Switch (TOS) red light is on from grinding head carrier overload	**A.** Too high grinding head traverse speed, or too heavy grinding stock removal or combination causes the overload switch to trip out. The red (LED) on the Control Panel Overload Reset Button lights up with a motor overload condition.	(TOS) Red light is on - reset switch, Traverse works Yes--end troubleshooting No--go to Step **B.** next
Traverse Speed Pot (TSP) set to zero	**B.** Set (TSP) to 35 on the control panel	Traverse works Yes--end troubleshooting No--go to step **C.** next
Circuit Breaker 4 (CB4) (2 amp) tripped out	**C.** Too heavy a grind causes grinding head traverse motor to overload and trip the circuit breaker. Reset (CB4)	Traverse works Yes--end troublshooting No--go to Step **D.** next
Traverse Drive Control (TDC) is bad	**D.** Check for incoming 44 Volts DC at (TDC) Jumper J1	(TDC) Green LED D14 is on with 44 Volts DC at term J1 #1 to #4 Yes--go to Step **H.** next No--go to Step **E.** next
	E. Check for 115 Volts AC incoming to (TDC)	On (TDC) white wire #32 to black wire #33 for 115 Volts AC Yes--replace (TDC) No--go to Step **F.** next
Bad wires to (TDC)	**F.** Check for 115 Volts AC at circuit breaker	(CB4) Black wire #33 to Wire Block 1 (WB1) (white) wire #32 for 115 Volts AC Yes--replace wires #33 & 32 No--go to step **G.** next
(CB4) is bad (2 amp)	**G.** Check for (CB4) normally closed contacts	(CB4) black wire #59 to (WB1) white wire #32 for 115 Volts AC Yes--replace (CB4) No--replace wire #59

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
No DC Voltage from (TDC) Traverse Drive Control	**H.** Check for 33 Volts DC across (TDC) jumper #J1 terminals #2 to 3 this voltage drives the DC traverse motor. NOTE: Traverse must be on and have (TSP) turned full CW to maximum voltage of 33 VDC	Check (TDC) jumper #J1 terminals #2 to #3 for 33 Volts DC Yes--go to step **I.** next No--go to Step **J.** next
Traverse Motor is bad	**I.** Check grinding motor continuity	Remove wires from Jumper #J1 terminals #2 & #3 0 ohms across the black and white wires Yes--end troubleshooting No--go to Step **S.** next
(TSP) is not working	**J.** Check (TSP) (10K) on control panel	(TDC) Pin #8 to 5 Pot Full CCW Pot Full CW 0 VDC 2.98 VDC Pin #8 to 6 Pot Full CCW Pot Full CW 1.92 VDC 0 VDC Yes-- go to Step **L.** next No--go to step **K.** next
(TSP) (10K) is bad	**K.** Check (TSP) for 10,000 ohms Remove three wires from (TDC) red from term #8 white from term #5 black from term #6	Check for 10,000 ohms red to white wires Full CCW--0 ohms Full CW--10,000 ohms Red to black wires Full CCW--10,000 ohms Full CW--0 ohms Yes--go to Step **L.** next No--replace (TSP)
(TDC) is bad NOTE:Check outputs 1,2, & 3 as a group. They are interactive to each other.	**L.** Output 1 left/right traverse from (IOC) actuating through (TJS) Traverse Jog Switch	(TDC) jumper J2 to pin #4 to #1 Traversing left--0 VDC Traversing right--24 VDC
	Output 2 on/off accel from (IOC) actuating through (TJS)	(TDC) Jumper J2 Pin #11 to #1 Traverse stopped or traverse on--24 VDC
	Output 3 Brake Dynamic from (IOC) actuating through (TJS)	(TDC) Jumper J2 Pin #9 to #1 Traversing stopped (not pushing jog button) brake on--0 VDC Traversing on (pushing jog button) brake off--24 VDC Yes--replace (TDC) No--go to Step **M.** next

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
(IOC) Input Output Controller is bad NOTE: Check outputs 1,2, & 3 as a group. They are interactive to each other.	**M.** Output 1 left/right (TJS)	(IOC) Pin #31 to 22 Push (TJS) to traverse left--0VDC Push (TJS) to traverse right--24 VDC
	Output #2 on/off accel (TJS)	(IOC Pin #30 to 22 (TJS) push or not push--24 VDC
	Output #3 Brake Dynamic (TJS)	(IOC) Pin #29 to 22 (TJS) not pushed, brake on--0 VDC (TJS) pushed, brake off--24 VDC Yes--replace wires 24, 26, 27 No--go to Step **N.** next
	N. Input 13 (TJS) Jog to the right	(IOC) Pin #23 to 16 ground Switch centered--0 VDC Traverse right--24 VDC
	Input 12 (TJS) Jog to the left	(IOC) Pin #20 to 16 ground Switch centered--0 VDC Traverse left--24 VDC Yes--replace (IOC) No--go to Step **P.** next
(TJS) is bad	**P.** Check (TJS) Contacts open ohm reading 1 Contacts closed ohm reading 0	Check ohm reading when machine power is off Between terminal #1 & 2 (push for traverse right) --ohm reading 0 term 1&2 and 2&3 (switch centered not pushed)--ohm reading 1 terminal #2 & 3 (push for traverse left)--ohm reading 0 Yes--go to step **Q.** next No--replace (TJS)
(TDC) is not working	**Q.** At (TDC) Check for a closed circuit across term #12 to #13 (This checks (TOS) input)	(TDC) Term #12 to 13 with power on 0 Volts DC Yes-- replace (TDC) No--reads 24 Volts DC go to step **R.** next
(TOS) is bad	**R.** Check that (TOS) contacts are normally closed (TDC) Red light is off at D2, No overload	(TOS) across Term C-common & Term NC-normally closed check for 0 Volts DC Yes--replace (TDC) No--reads 24 Volts - replace (TOS)
Worn motor brushes	**S.** Inspect Motor Brushes	Remove the brushes one at a time and maintain orientation for reinsertion. See if brush is worn short, 3/8" [10 mm] minimum length. Yes--replace motor brushes No--replace Spin Drive Motor

PROBLEM--Traverse does not stop to reverse directions when flag goes under the proximity switch on the left side or right side of machine.

Possible Cause	Checkout Procedure	
Gap between flag and prox is incorrect.	A. Gap between flag and prox should be 3/16 to 1/4" [4-6 mm]. Prox LED does not light when flag is under prox.	If incorrect, adjust per adjustment section of manual. Traverse works-- Yes--end troubleshooting No--go to Step **B.** next
Proximity Switch is bad.	B. Check Prox Switch output when:	
	Grinding Head is at the left traverse proximity.	(IOC) Pin #15 to #21 Prox light on--0 Volts DC Prox light off--24 Volts DC Yes--replace (IOC) Input Output Controller No--replace left traverse prox
	Grinding Head is at the right traverse proximity	(IOC) Pin #14 to #21 Prox light on--0 Volts DC Prox light off--24 Volts DC Yes--replace (IOC) No--replace right traverse prox

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--Stepper Infeed not working in (manual) jog mode.

Assuming (SSS) System Start Switch is on and (AMS) Auto/Manual Switch is in (manual) jog with 115 Volts AC to control panel and all other manual (jog) mode functions are working.

In your Product Packet Assembly, there are a series of prints. Find the print titled <u>Stepper Infeed Controls</u> before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire terminals with approximately 3 lbs force all terminals to verify there are no loose terminal connections and/or loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

Possible Cause	Checkout Procedure	
Infeed Jog Switch (IJS) is not held to on position	**A.** (IJS) Hold switch on in either direction	Stepper motor works Yes--end troubleshooting No--go to Step **B.** next
Circuit Breaker 3 (CB3) is tripped (2 amp)	**B.** Reset circuit breaker switch (tripped by current overload) Grinding head stepper infeed mechanism jammed causing overload	Stepper Motor works Yes--end troubleshooting No--go to step **C.** next
Infeed travel does not permit the grinding head to go up farther. NOTE: When the proximity switch light is on the Stepper Infeed cannot go up.	**C.** Verify that Prox 13 is lit. If yes, grinding head up is too high and turns on Prox #13, Infeed Travel Limit up proximity. If yes, verify proximity positioning as described in adjustment section. If yes, reposition and realign mowing unit lower so upper prox light is off.	Stepper works Yes--end troubleshooting No--go to Step **D.** next
Infeed travel does not permit the grinding head to go down farther. NOTE: When the proximity switch light is on the stepper infeed cannot go down.	**D.** Verify that Prox 14 is lit. If yes, grinding head is too low and turns on Prox #14, infeed travel limit down proximity. If yes, verify proximity positioning as described in adjustment section. If yes, reposition and realign mowing unit higher so lower prox light is off.	Stepper works Yes--end troubleshooting No--go to Step **E.** next
High Low Switch (HLS) is not on high speed	**E.** (HLS) put switch on high speed for ease of checkout of Stepper Infeed Control (SIC)	High speed works Yes--end troubleshooting No--go to Step **F.** next
Stepper motor drive coupling is loose	**F.** You can feel stepper pulses on motor when (HLS) is on high or low & (IJS) switch is depressed in either up or down direction. Open stepper infeed inspection plate to check for loose coupling. Retighten coupling to drive actuator screw. See adjustment section of manual.	Stepper works-- Yes--end troubleshooting No--go to Step **G.** next

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
No AC voltage to Stepper Infeed Control (SIC)	**G.** Check for 115 Volts AC across (SIC) terminals labeled 115 Volt AC (Red indicator light is on when AC power is on)	(SIC) Term at AC 115 Volts AC (white) wire #64 to (black) wire #65 Yes--go to step **H.** next No--go to step **I.** next
Input Output Controller (IOC) 5 Volts DC power supply is bad.	**H.** Check for 5 to 5.5 Volts DC on (IOC)	(IOC) Pin #4 to Jumper JP12 term #3 blue wire for 5 to 5.5 Volts DC Yes--go to step **K.** next No--replace (IOC)
Bad wires to (TDC)	**I.** Check for 115 Volts AC at circuit breaker	(CB3) black wire #65 to Wire Block 1 (WB1) (white) wire #64 for 115 Volts AC Yes--replace wires 64 & 65 No--go to step **J.** next
(CB3) is bad (2 amp)	**J.** Check for (CB3) normally closed contacts	(CB3) black wire #59 to (WB1) white wire #64 for 115 Volts AC Yes--replace (CB3) No--replace wire 59
Outputs from (IOC) are bad	**K.** Check at (IOC) for the (IJS) function.	(IOC) Pin #47 to #04 Hold on (IJS) for high speed 7.5 mV DC Hold on (IJS) for low speed 2.8 mV DC Yes--go to Step **M.** next No--go to Step **O.** next
Outputs from (IOC) are bad	**L.** Check direction output signal at (IOC). Toggle the (IJS). Have (HLS) High/Low Switch set on high speed	(IOC) Pin #48 to #04 Hold on (IJS) for infeed up 5 to 5.5 Volts DC Hold on (IJS) for infeed down 0 Volts DC Yes--go to Step **N.** next No--got to Step **Q.** next
Stepper Infeed Control (SIC) or Stepper motor is bad	**M.** Check output at (SIC). Toggle the (IJS) Have (HLS) High/Low Switch set on high speed	(SIC) Terminal pulse + to terminal pulse - Hold on (IJS) for high speed 7.5 mV DC Hold on (IJS) for low speed 2.8 mV DC Yes--replace (SIC) and stepper motor No--replace wire #41
	N. Check direction signal at (SIC). Toggle the (IJS) Have (HLS) set on high speed	(SIC) Terminal CW/CWW+ to CW/CWW- Hold on (IJS) for infeed up 5 to 5.5 Volts DC Hold on (IJS) for infeed down 0 Volts DC Yes--replace (SIC) and stepper motor No--replace wire #41

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
(HLS) is not working	**O.** Check Input 9 (HLS) for Jog Speed	(IOC) Pin #26 to Pin #16 Switch up (High speed)--24 V DC Switch down (Low speed)-- 0 Volts DC Yes--go to step **L.** next No--go to step **P.** next
(HLS) is bad	**P.** Check (HLS) continuity	(HLS) Term #1 to term #2 Check ohm reading when machine electrical power is off (High speed) switch up --0 ohm reading (Low speed) switch down --1 ohm reading Yes--replace (IOC) No--replace (HLS)
(IOC) is bad	**Q.** Check input 15 (IJS)	(IOC) Pin #18 to Pin #21 Switch stationary (centered, not held on)--24 VDC Hold on (IJS) for infeed up--0 VDC Yes-go to Step **R.** next No--go to Step **S.** next
	R. Check input 14 (IJS) Infeed Jog Switch	(IOC) Pin #19 to 21 Switch stationary (centered, not pushed)--24 VDC Hold on (IJS) for infeed down--0 VDC Yes--Replace (IOC) No--go to Step **S.** next
(IJS) is bad	**S.** Check (IJS) continuity Contacts open ohm reading 1 Contacts closed ohm reading 0	Check ohm reading when machine is off Between terminal #1 & 2 Hold on (IJS) for infeed down--0 ohm reading Terminal 1 to 2 and 2 to 3 (Switch centered, not held on)--1 ohm reading Between terminal #2 & 3 Hold on (IJS) for infeed up--0 ohm reading Yes--replace wire #93 & 94 No--replace (IJS)

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--In Manual (Jog) cycle there is no (LDC) Liquid Display or Manual (jog) functions.

Assuming (SSS) System Start Switch is on with 115 Volts AC to the control panel.

In your Product Packet Assembly, there are a series of prints. Find the print titled Input Output Controller, before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire terminals with approximately 3 lbs force to verify there are no loose terminal connections and/or loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

Possible Cause	Checkout Procedure	
Circuit Breaker 5 (CB5) is tripped (.5 amp)	**A.** Reset circuit breaker switch	Display works and manual functions work Yes--end troubleshooting No--go to Step **B.** next
No 24 Volts DC power at Input Output Controller (IOC)	**B.** Check that red (LED) light is on IOC board at D21 indicating 24 Volts DC is supplied for inputs and outputs.	Voltage at (IOC) jumper JP12 terminal #1 & #2 for 24 Volts DC Yes--go to Step **G.** next No--go to Step **C.** next
	C.Check for 115 Volts to 24 Volt power supply	115 Volts AC at (white wire) Term #AC(N) and (black wire) Term #AC(L) Yes--replace 24 Volt DC power supply No--go to Step **D.** next
(IOC) has no 115 V power supplied	**D.** Check power across (IOC) term #03 to #02 for 115 Volts AC	(IOC) Check pin #03 to 02 for 115 Volts AC Yes--replace (IOC) No--go to Step **E.** next
Wire #60 is bad	**E.** Check for 115 Volts AC to circuit breaker	Wire Block 1 (WB1) (white) wire #60 to (CB5) (black) wire #60 for 115 Volts AC Yes--replace wire #60 No--go to Step **F.** next
(CB5) is bad (.5 amp)	**F.** Check for (CB5) normally closed contacts	(WB1) (white) wire #60 to (CB5) (black) wire #59 for 115 Volts AC Yes--replace (CB5) No--replace wire #59
Auto/Manual Switch (AMS) is bad NOTE: (AMS) switch to be in manual (jog) mode.	**G.** Check (IOC) Input 10 (AMS) in jog	(IOC) Check pin #25 to #21 Auto on--24 Volts DC Manual (jog) on--0 Volts DC Yes--go to Step **I.** next No--go to Step **H.** next

ELECTRICAL TROUBLESHOOTING (Continued)

Possible Cause	Checkout Procedure	
(AMS) is bad	**H.** Check (AMS) switch continuity	Check ohm reading when machine electrical power is off. Check between Term #1 to #2 Auto on--1 Ohm reading Manual (jog) on--0 Ohm reading Yes--replace wires #95 and #76 No--replace (AMS)
(GSS) Grind Selector Switch is bad	**I.** (IOC) Input 11 for (GSS) Spin/relief modes	(IOC) Pin #24 to #21 Spin on--24 Volts DC Relief on--0 Volts DC Yes--go to Step **K.** next No--go to Step **J.** next
	J. Check (GSS) continuity	Check ohm reading when machine electrical power is off. Check between (GSS) Term #1 to #2 Spin on --1 Ohm reading Relief on --0 Ohm reading Yes--replace wires #76 and #96 No--replace (GSS)
Ribbon cable improperly installed	**K.** Verify at (IOC) Jumper JP5 Liquid Crystal Display (LCD) ribbon cable has red wire to the right matched to pin #1. At (LCD) ribbon cable has red wire matched to pin #1. Reposition if incorrect.	Display works Yes--if LCD works and displays a system error message, then refer to separate troubleshooting sheets on Manual (Jog) cycle mode system error messages. No--replace ribbon cable and LCD

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--No Manual (jog) cycle mode because of a system error message on LCD. Display message START JOGGING is required in Liquid Crystal Display to permit manual grinding operations.

JOG CYCLE
START JOGGING

In your Product Packet Assembly, there are a series of prints. Find the print titled <u>Input/Output Controller</u> before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire installation with approximately 3 lbs force all terminals to verify there are no loose terminal connections and/or no loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

System Error Message	Checkout Procedure	
Warning turn 3 motor switches off	**A.** Turn off Dust Collector Motor Grinding Wheel Motor and Spin Drive Motor	Message Status Gone--Proceed to next system error message or you have Start Jogging display Remains--go to Step **B.** next
	B. Check Input/Output Controller (IOC) Pin #13 to #11 with all three motors off	(IOC) Pin #13 to #11 24 Volts DC Yes--replace (IOC) No--one of the three switches is defective - investigate
Jog cycle infeed limit sw [up]	**A.** Infeed grinding head down only so prox #13 light is off	Message Status Gone--Proceed to next system error message or you have Start Jogging display
	B. Check (IOC) input from prox 13	Remains--go to Step **B.** next (IOC) Pin #6 to #11: Prox light off 24 volts DC. Prox lit 0 Volts DC Yes--replace (IOC) No--replace prox 13
Jog cycle infeed limit sw [dn]	**A.** Infeed grinding head up only so prox #14 light is off	Message Status Gone--Proceed to next system error message or you have Start Jogging display
	B. Check (IOC) input from prox 14	Remains--go to Step **B.** next (IOC) Pin #12 to #16: Prox light off 24 volts DC. Prox lit 0 Volts DC Yes--replace (IOC) No--replace prox 14

ELECTRICAL TROUBLESHOOTING (Continued)

System Error Message	Checkout Procedure	
Finger isn't in spin position (INP 7 OFF)	**A.** Rotate index finger assembly to spin position prox #15 light to be off	Message Status Gone--Proceed to next system error message or you have Start Jogging display Remains--go to Step **B.** next
	B. Check (IOC) input from prox 15	(IOC) Pin #7 to #11: Prox light off 24 volts DC. Prox lit 0 Volts DC Yes--replace (IOC) No--replace prox 15
Finger not in relief position (inp 7 on)	**A.** Rotate index finger assembly to relief position prox #15 light is on	Message Status Gone--Proceed to next system error message or you have Start Jogging display Remains--go to Step **B.** next
	B. Check (IOC) input from prox 15	(IOC) Pin #7 to #11: Prox light off 24 volts DC. Prox lit 0 Volts DC Yes--replace (IOC) No--replace prox 15

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--No automatic cycle spin mode because of a system error message on LCD. Display message PRESS PROG START SWITCH is required in Liquid Crystal Display to permit automatic spin grinding operation.

SPIN AUTO CYCLE
PRESS PROG START SW

In your Product Packet Assembly, there are a series of prints. Find the print titled <u>Input/Output Controller</u> before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire installation with approximately 3 lbs force all terminals to verify there are no loose terminal connections and/or loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

System Error Message	Checkout Procedure	
Finger isn't in spin Position (INP 7 OFF)	**A.** Rotate index finger assembly to spin position Prox #15 light to be off	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check Input Output Controller (IOC) for Prox 15 input. Prox-light is off	(IOC) Pin #07 to #11 Prox light off--0 Volts DC. Prox lit--24 Volts DC Yes--replace (IOC) No--replace Prox 15
Carrier not at home RT TRV SW (INP 2 off)	**A.** Traverse grinding head carrier to right traverse switch Prox #12 light to be on	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check (IOC) for Prox 12 input. Prox light is on	(IOC) Pin #14 to #11 Prox lit--24 Volts DC Prox light off--0 Volts DC Yes--replace (IOC) No--replace Prox 12
Spin Drive motor is not on (INP 5 Off)	**A.** Turn spin motor switch (SMS) on	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check (IOC) for (SMS) input	(IOC) Pin #09 to #11 (SMS) on--24 Volts DC (SMS) off--0 Volts DC Yes--replace (IOC) No--(SMS) defective-investigate

ELECTRICAL TROUBLESHOOTING (Continued)

System Error Message	Checkout Procedure	
Check Dust Collector grinding wheel motor door interlock switch (INP 3 Off)	**A.** Turn Dust Collector Switch (DCS) on, Turn Grinding Wheel Switch (GMS) on and Grinder doors to be closed check Prox #17 light is on	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check (IOC) for (DCS), (GMS), and Prox 17 input, Prox light is on	(IOC) Pin #13 to #11 Prox lit--0 Volts DC Prox light off--24 Volts DC Yes--replace (IOC) No--one of the two switches or the prox is defective-investigate
Spin Auto Cycle index Finger up	**A.** Push reel index finger down and insert locking pin Prox #16 light is on.	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check (IOC) for Prox 16 input light is on	(IOC) Pin #08 to #11 Prox lit--0 Volts DC Prox light off--24 Volts DC Yes--replace (IOC) No--replace Prox 16
Spin Auto Cycle Programs (1-2-3-4-5)	**A.** Select correct spin program 1-2-3-4 or 5	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check single digit thumbwheel & ribbon cable connections.	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--replace single thumbwheel and ribbon cable.

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--No automatic cycle relief mode because of a system error message on LCD . Display message PRESS PROG START SWITCH is required in Liquid Crystal Display to permit automatic relief grinding operation.

RELIEF AUTO CYCLE
PRESS PROG START SW

In your Product Packet Assembly, there are a series of prints. Find the print titled <u>Input/Output Controller,</u> before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire installation with approximately 3 lbs force all terminals to verify there are no loose terminal connections and/or no loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

System Error Message	Checkout Procedure	
FINGER NOT IN RELIEF POSITION (INP 7 ON)	**A.** Rotate index finger assembly to relief position prox #15 light is on	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check (IOC) for prox 15 input prox light is on	(IOC) Pin #07 to #11 Prox lit--24 Volts DC Prox light off--0 Volts DC Yes--replace (IOC) No--replace Prox 15
CARRIER NOT AT HOME RT TRV SW (INP 2 OFF)	**A.** Traverse grinding head carrier to right traverse switch prox #12 light is on	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check (IOC) for Prox 12 input Prox light is on	(IOC) Pin #14 to #11 Prox lit--24 Volts DC Prox light off--0 Volts DC Yes--replace (IOC) No--replace Prox 12
SPIN DRIVE MOTOR IS NOT ON (INP 5 OFF)	**A.** Turn spin motor switch (SMS) on	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check (IOC) for (SMS) input Motor switch is on	(IOC) Pin #09 to #11 (SMS) on--24 Volts DC (SMS) off--0 Volts DC Yes--replace (IOC) No--(SMS) defective-investigate

ELECTRICAL TROUBLESHOOTING (Continued)

System Error Message	Checkout Procedure	
CHECK DUST COLLECTOR GRINDING WHEEL MOTOR DOOR INTERLOCK SWITCH (INP 3) OFF	**A.** Turn Dust Collector Switch (DCS) on, Turn Grinding Motor Switch (GMS) on and grinder doors to be closed Prox #17 light is on	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check (IOC) for (DCS), (GMS) and Prox 17 input, Prox light is on	(IOC) Pin #13 to #11 Prox lit--0 Volts DC Prox light off--24 Volts DC Yes--replace (IOC) No--one of the two switches or the prox is defective-investigate.
RELIEF AUTO CYCLE PROGRAMS [6-7-8-9-0]	**A.** Select correct relief program 6-7-8-9 or 0	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check single digit thumbwheel & ribbon cable connections.	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--replace single thumbwheel and ribbon cable
RELIEF AUTO CYCLE BLADES (4-11)	**A.** Select correct number of reel blades 4 thru 11	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check double digit thumbwheel & ribbon cable connections.	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--replace double thumbwheel and ribbon cable

ELECTRICAL TROUBLESHOOTING (Continued)

System Error Message	Checkout Procedure	
INDEX FINGER UP CYC XX INF XXX PRG X	**A.** Mid cycle error message in automatic relief mode. Index finger is not down at right hand traverse end so prox #16 light off. Correct by indexing reel blade so index finger is down and Prox 16 light is on	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check (IOC) for Prox 16 input.	(IOC) Pin #06 to #11 Prox lit--0 Volts DC Prox light off--24 Volts DC Yes--replace (IOC) No--replace Prox 16
INDEX FINGER DOWN CYC XX INF XXX PRG X	**A.** Mid cycle error message in automatic relief mode. Index finger is not up at left hand traverse end so prox #16 is on. Correct by clearing reel blade so index finger comes up and Prox 16 light is off.	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check (IOC) for Prox 16 input	(IOC) Pin #06 to #11 Prox lit--0 Volts DC Prox light off--24 Volts DC Yes--replace (IOC) No--replace Prox 16
RELIEF CYCLE BLD X INFEED LIMIT SW [UP]	**A.** Mid cycle error message in automatic relief mode. Prox #13 light to be off for cycle to function. Automatic Infeed has hit up travel limit Prox 13 which lit. Correct by repositioning and realigning reel so grinder can infeed.	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **B.** next
	B. Check that Prox 13 position is correct as specified in adjustment section of Manual.	Message Status Gone--Proceed to next system error message or you have PRESS PROG START SW display Remains--go to Step **C.** next
	C. Check (IOC) for Prox 13 input.	(IOC) Pin #06 to #11 Prox lit--0 Volts DC Prox light is off--24 Volts DC Yes--replace (IOC) No--replace Prox 13

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--No Automatic cycle when pressing Program Start Switch (PSS).

Assuming System Start Switch (SSS) is on with 115 Volts AC to the control panel. The Liquid Crystal Display (LCD) needs to be functioning for diagnostic purposes. The manual jog cycle is functioning.

In your Product Packet Assembly, there are a series of prints. Find the print titled <u>Input/ Output Controller,</u> before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire terminals with approximately 3 lbs force to verify there are no loose terminal connection and/or no loose crimps between wire and terminal. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

Possible Cause	Checkout Procedure	
Program Start Switch (PSS) will not start Program until display message reads one of the messages below: RELIEF AUTO CYCLE PRESS PROG START SW or SPIN AUTO CYCLE PRESS PROG START SW See specific display message errors for manual mode, spin auto or relief auto mode see troubleshooting sheets.	**A.** Check Input Output Controller (IOC) Input 16 (PSS)	(IOC) Check pin #17 to #16 Held down--0 VDC Up position--24 VDC Yes--replace (IOC) No--go to Step **B.** next
	B. Check (PSS) switch continuity NOTE: the (PSS) is spring loaded up. If the switch should stick down after being pressed for automatic cycle start the machine will go thru the grinding cycle and then restart into the next cycle. Replace (PSS) if it should stick.	Check ohm reading when machine electrical power is off. Check between Term C to Term NC Held down (normally closed) Ohm reading--0 Up position (normally open) Ohm reading--1 Yes--replace (IOC) check to make sure all display messages are satisfied first before replacing (IOC) No--replace (PSS)

ELECTRICAL TROUBLESHOOTING (Continued)

PROBLEM--Flasher light does not turn on at beginning or end of automatic cycle.

In your Product Packet Assembly, there are a series of prints. Find the print titled <u>Flasher Light Controls</u>, before starting the troubleshooting below. Verify all wires shown on that drawing are correct and pull on wire terminals with approximately 3 lbs force to verify there are no loose terminals. If loose terminals are found, tighten and retest system. If problem persists, test as listed below.

Possible Cause	Checkout Procedure	
No 115 Volts AC to Relay #2 (RE2) for flashing light	**A.** Check for 115 Volts AC at Check for display to read (RE2) Check in auto cycle SPIN AUTO CYCLE PRESS PROGRAM START or RELIEF AUTO CYCLE PRESS PROGRAM START	(RE2) Term 4 to term 8 for 115 Volts AC Yes--go to Step **C.** next No--go to Step **B.** next
	B. Check for 115 Volts AC at Wire Block 1 (WB1)	(WB1) Wire #67 (black) to Wire #68 (white) for 115 Volts AC Yes--replace wires 67 & 68 No--check main AC power source in troubleshooting section
(IOC) Input Output Control	**C.** Check for 115 Volts AC at (RE2)	(RE2) Term 2 to term 6 for 115 Volts AC Yes--go to step **E.** next No--go to Step **D.** next
	D. Check output #5 flashing light voltage control to Relay #2 (RE2) Check for display to read SPIN AUTO CYCLE PRESS PROGRAM START or RELIEF AUTO CYCLE PRESS PROGRAM START	Check (IOC) Terminals 28 to 22 0 VDC Yes--got to Step **E.** next No--replace (IOC)
Flasher (FLR) is bad	**E.** (FLR) Unplug flasher at terminal 2 and other lead to black wire. Plug black wire of flasher cord 8 directly into terminal 2 of (RE2)	Light goes on steady with no flashing Yes--replace flasher No--go to Step **F.** next
No voltage to flashing light	**F.** Check voltage across the light terminals for 115 Volts AC	Across black and white wires to bulb 115 Volts AC Yes--replace bulb No--replace flasher cord #08

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MECHANICAL TROUBLESHOOTING

PROBLEM--Actuator drive shaft whipping excessively at high traverse speed.

Possible Cause	Checkout Procedure
Bearings were bolted down tightly with bearings putting a bow into the drive shaft.	Loosen bearing blocks and check squareness of bearing collar face 90 degrees to carriage rods with a square and tighten down. The drive shaft to carriage front shaft is 2.875 +/- .010" [73 +/-.3 mm] apart. See adjustment section for more information.

PROBLEM--Reels ground have high/low blades.

Traverse Speed set to fast.	Check roundness using a magnetic base dial indicator. Traverse speed should be set approximately 12 ft/min [4 meters/min] if roundness is varying.
Lineal bearings for the grinding head carriage are out of adjustment (loose) or have grit buildup causing uneven traversing load.	Relubricate and adjust linear bearings per adjustment section. If problem persists, replace lineal bearings on the carriage base. Check for any holes in the bellows that would permit any grinding grit penitration. See adjustment section for lineal bearing replacement.

PROBLEM--Excessive grinding stock being removed when traversing to the right in the relief grinding mode.

Gib adjustment for the relief finger assembly is loose so reel finger has movement. When traversing to the right minimum grinding stock removal should be seen as compared with heavy stock removal when traversing to the left.	Tighten the set screws for the gib adjustment. See procedure in the adjustment section in the manual.

PROBLEM--Grinding stock removal from reel is irregular during spin grinding.

Lineal bearings on the grinding head carriage are too loose.	The lineal bearing must be preloaded to the traverse shafts with no vertical movement. See manual adjustment section for carriage linear bearing adjustments.

PROBLEM--Carriage traversing varies speed while grinding.

Oil on carriage drive shaft.	Wipe oil completely from the traverse shaft. Spray down with a spray lubricant (do not use a teflon based lubricant) and wipe off completely.
Lineal bearings in the carriage do not rotate freely.	Check for grinding grit getting into the lineal bearings and cause excessive driving torque of carriage. Abrasive noise is detectable when excessive grit is in the lineal bearings. Replace the four lineal bearings in the main carriage. Check bellows for holes and replace if necessary.
Actuator bearings are not rotating freely.	Check bearings for free rotation or flat spots on the bearing outside diameter. Replace the six bearings if necessary. See adjustment section for bearing replacement.

MECHANICAL TROUBLESHOOTING (Continued)

PROBLEM--Too heavy a burr on cutting edge of reel blades.

Possible Cause	Checkout Procedure
Traverse speed set to high causing a heavy burr on the reel blade when spin grinding.	Traverse speed should be set lower approximately 12 ft/min. [4 meters/min.] for a smaller burr on cutting edge.

PROBLEM--Cone shaped reel after grinding.

Grinding head travel not parallel to the reel center shaft.	Grinding head travel was not setup parallel to the reel center shaft in vertical and horizontal planes. See Align the Reel Section in Operator's Manual.

PROBLEM--Relief grind on the reel blades do not go the full length of the reel.

The right side corner of the grinding wheel is always to be in contact with the reel blade. This is high point of the relief finger.	The right hand side of the grinding wheel is not in full contact for relief grinding. See Operator's Manual for NORMAL HELIX AND REVERSE HELIX for information of dressing the grinding wheel.

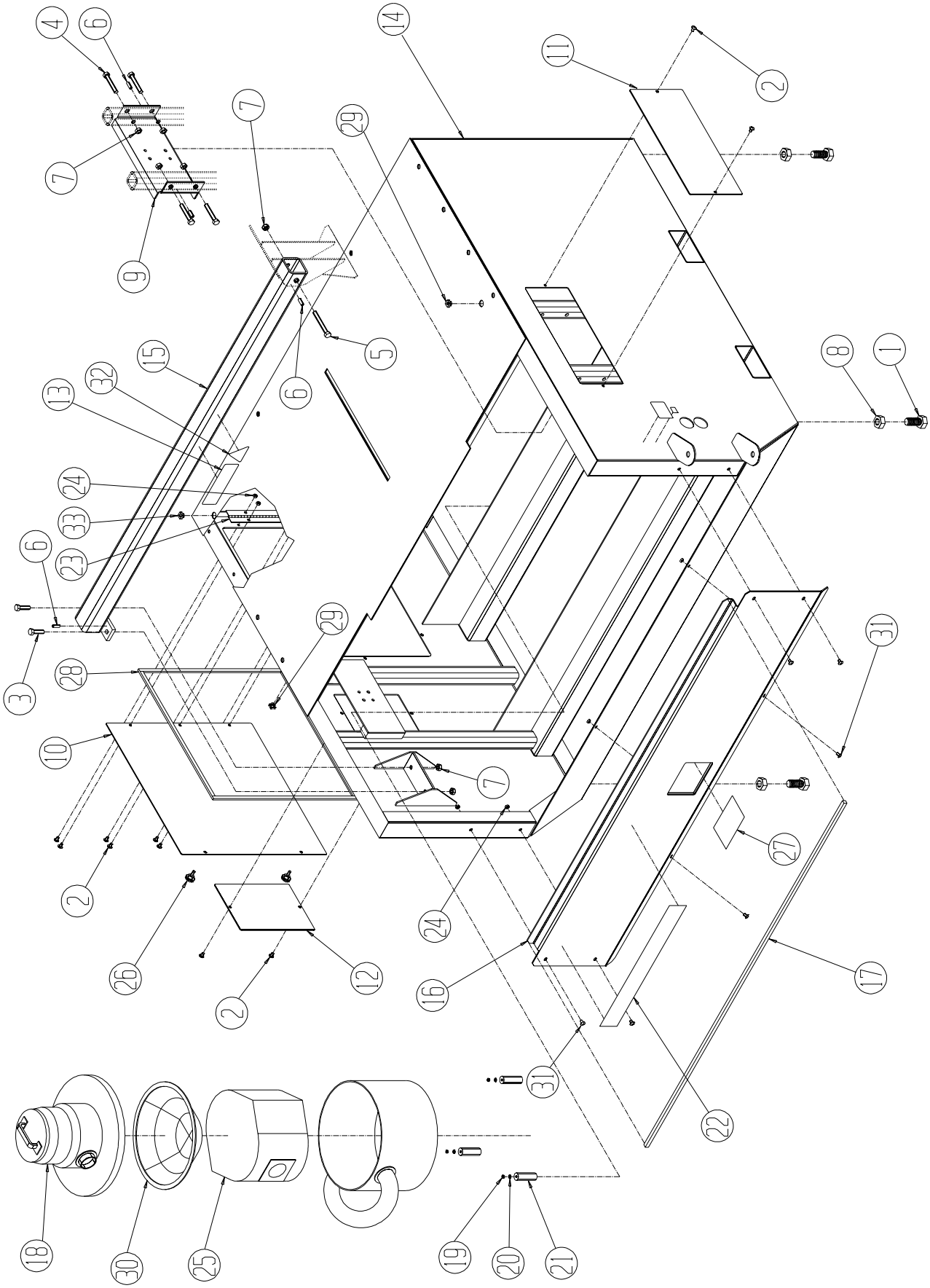
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DIAGRAM NO.	PART NO.	DESCRIPTION
1	A993201	Hex Head Cap Screw 1-8 x 2
2	B310813	Button Head Socket Cap Screw 5/16-18 x 1/2
3	B502801	Hex Head Cap Screw 1/2-13 x 1 3/4
4	B504801	Hex Head Cap Screw 1/2-13 x 3
5	B506401	Hex Head Cap Screw 1/2-13 x 4
6	H371602	Roll Pin 3/8 Dia. x 1.00 Long
7	J507100	1/2-13 Locknut
8	J992000	1-8 Hex Jam Nut
9	6509035	Mounting Frame Adjuster
10	6509038	Large Access Panel - Left Hand
11	6509039	Access Panel - Right Hand
12	6509040	Small Access Panel - Left Hand
13	6509116	Fuel Warning Decal
14	6509505	Main Frame Base Weldment
15	6509510	Tooling Bar Weldment
16	6509555	Removable Front Panel Weldment
17	3708379	Foam Strip
18	6509337	Vacuum Assembly
19	J257100	1/4-20 Locknut
20	K250101	1/4 Flatwasher
21	6509163	Tube - Rubber Vacuum Mounting
22	6509074	*ACCU*-Master Decal
23	6509300	Hinge
24	J317000	5/16-18 Lock Nut
25	3708428	Vac Bag
26	3709756	Knob
27	3708429	Foot Pad
28	3708378	Foam Strip .25 Thick
29	3707294	Heyco Bushing
30	3708437	Vacuum Cloth Filter
31	B311413	Button Head Cap Screw 5/16-18 x 7/8
32	3708526	Warning Decal Fuel, Symbol

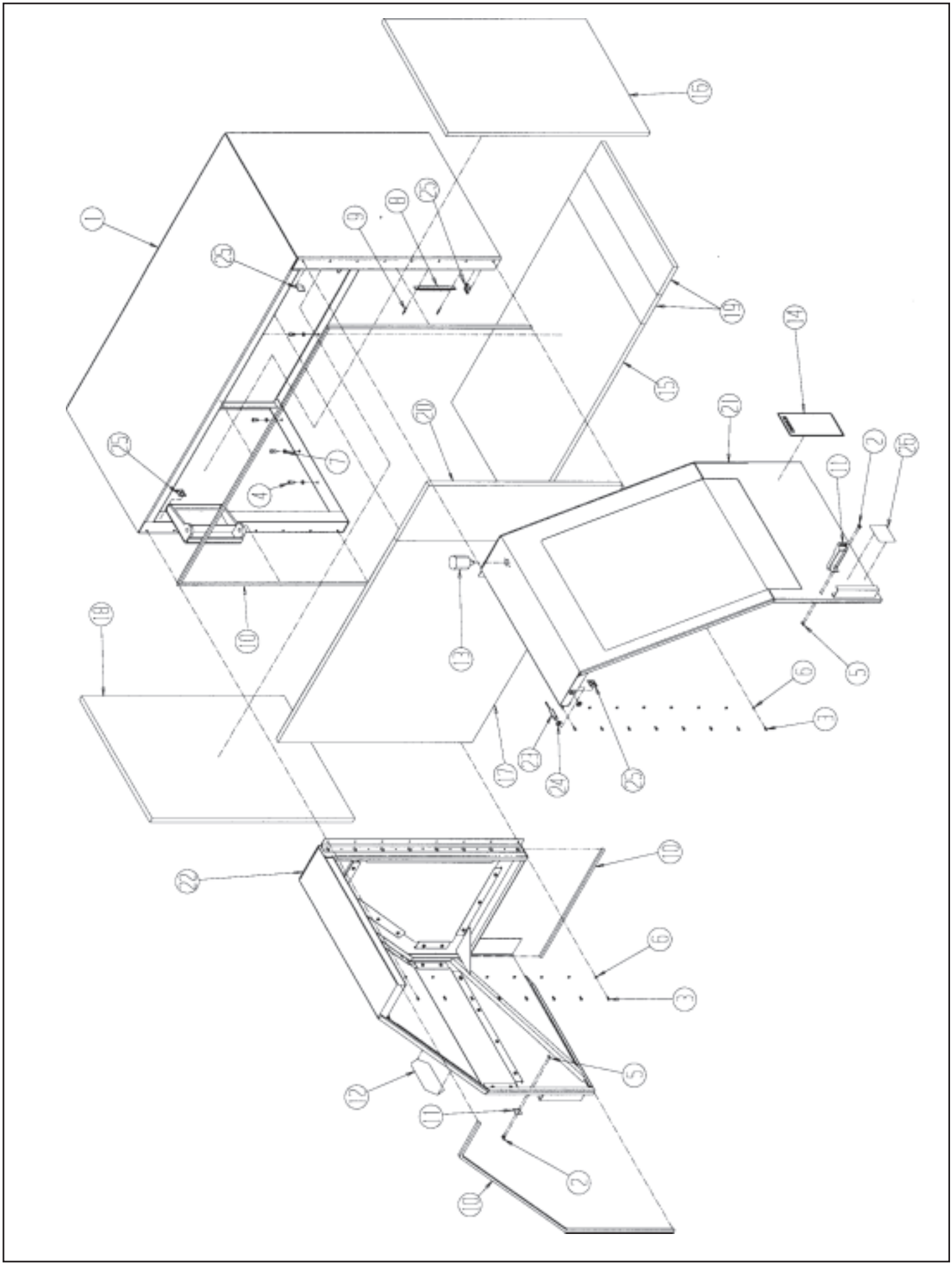

DIAGRAM NO.	PART NO.	DESCRIPTION
1	6509541	Canopy Frame Weldment
2	B190811	Socket Head Cap Screw 10 - 24 x 1/2
3	B310813	Socket Head cap Screw 5/16 -18
4	B371211	Socket Head Cap Screw 3/8 - 16 x 3/4
5	J197100	10 - 24 Locknut
6	K310001	5/16 Flatwasher
7	K371501	3/8 Split Lockwasher
8	3708205	Socket Holder
9	3708465	Blind Rivet
10	3708379	Foam Strip - .50 Thick
11	3708416	Soft Latch
12	3709990	Decal
13	3707448	Amber light 120 VAC
14	6509176	Warning Decal
15	6509217	Large Top Foam Pad
16	6509218	Foam Pad - Left Hand
17	6509219	Large Back Foam Pad
18	6509259	Foam Pad - Right Hand
19	6509260	Small Top Foam Pad
20	6509261	Small Back Foam Pad
21	6509539	Canopy Door Assembly - Right Hand
22	6509540	Canopy Door Assembly - Left Hand
23	6509327	Proximity Sensor - Wire 17
24	3707459	Proximity Sensor Nut
25	3707224	Cable Tie Holder-Typical used throughout machine
26	3708604	Decal - Warning Safety

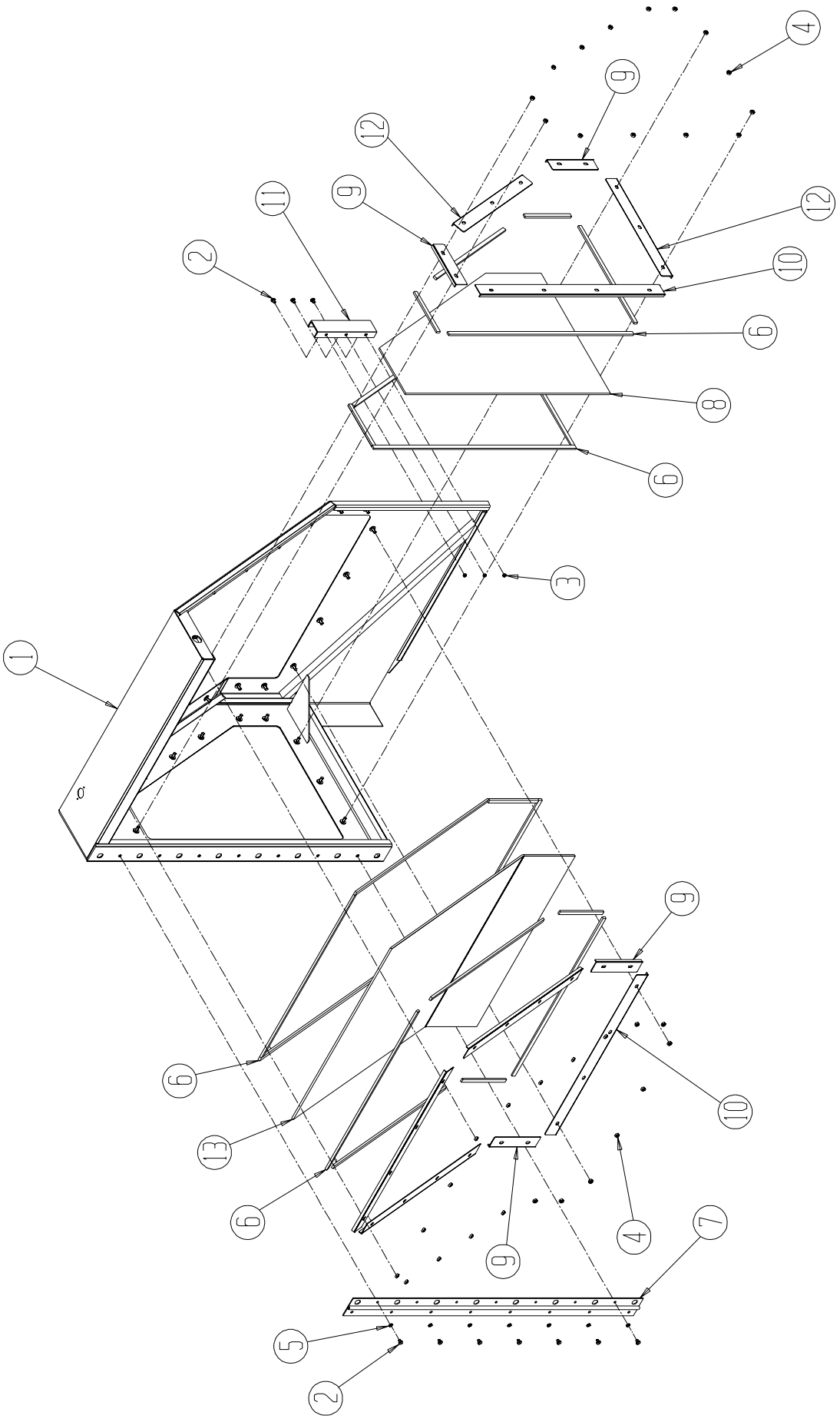
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DIAGRAM NO.	PART NO.	DESCRIPTION
1	6509535	Canopy Door Weldment - Right Hand
2	B250816	Button Head Socket Cap Screw 1/4-20 x 1/2
3	J257100	1/4-20 Locknut
4	J311000	5/16-18 Hex nut
5	K250001	1/4 Flatwasher
6	3708378	Foam Strip .25 Thick
7	6509099	Canopy Door Hinge
8	6509105	Canopy Door Side Window
9	6509111	Short Retaining Window Bracket
10	6509110	Long Retaining Window Bracket
11	6509112	Handle
12	6509182	Medium Retaining Window Bracket
13	6509104	Canopy Door Front Window

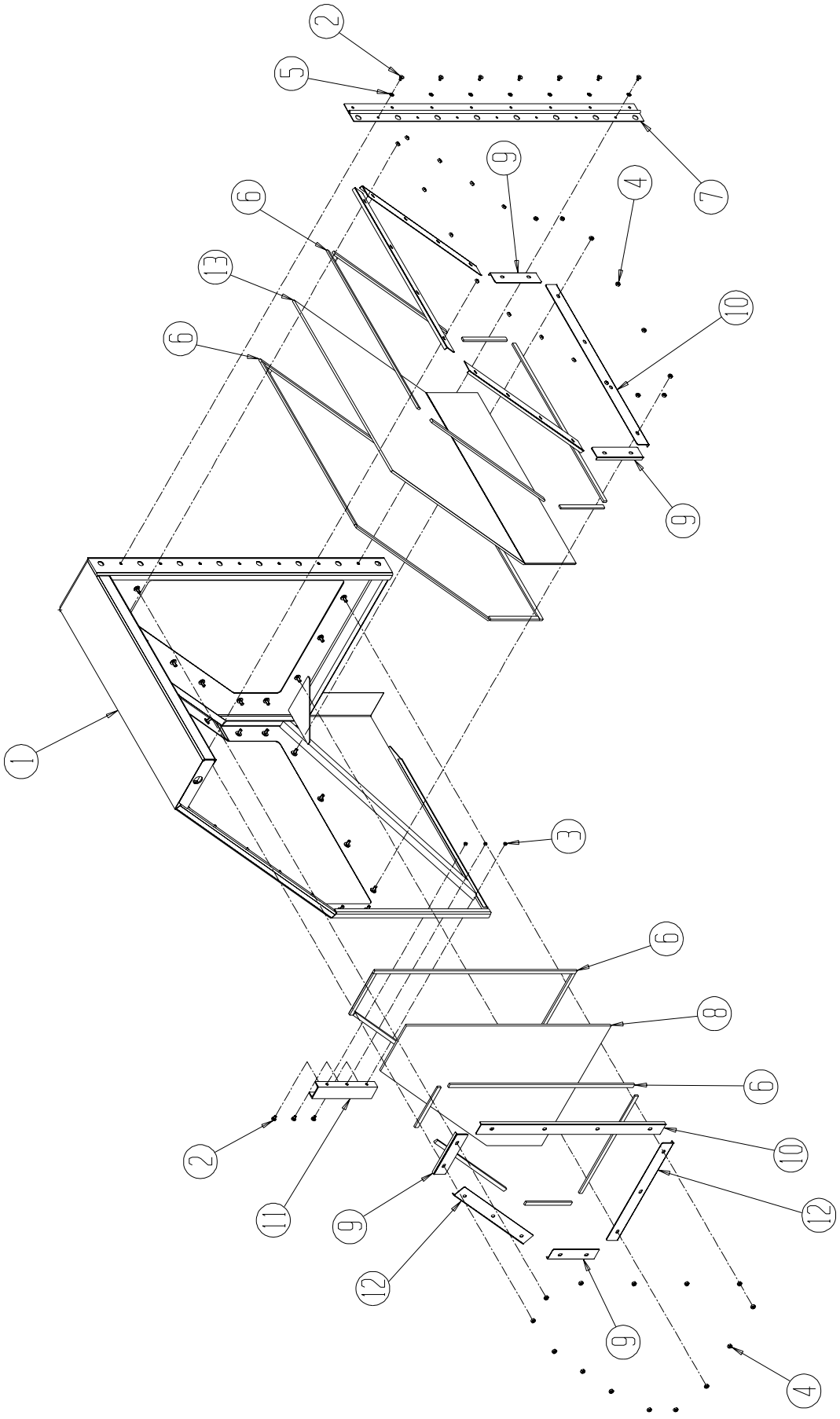
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DIAGRAM NO.	PART NO.	DESCRIPTION
1	6509536	Canopy Door Weldment - Left Hand
2	B250816	Button Head Socket Cap Screw 1/4-2 1/2
3	J257100	1/4-20 Locknut
4	J311000	5/16-18 Hex nut
5	K250001	1/4 Flatwasher
6	3708378	Foam Strip .25 Thick
7	6509099	Canopy Door Hinge
8	6509105	Canopy Door Side Window
9	6509111	Short Retaining Window Bracket
10	6509110	Long Retaining Window Bracket
11	6509112	Handle
12	6509182	Medium Retaining Window Bracket
13	6509104	Canopy Door Front Window

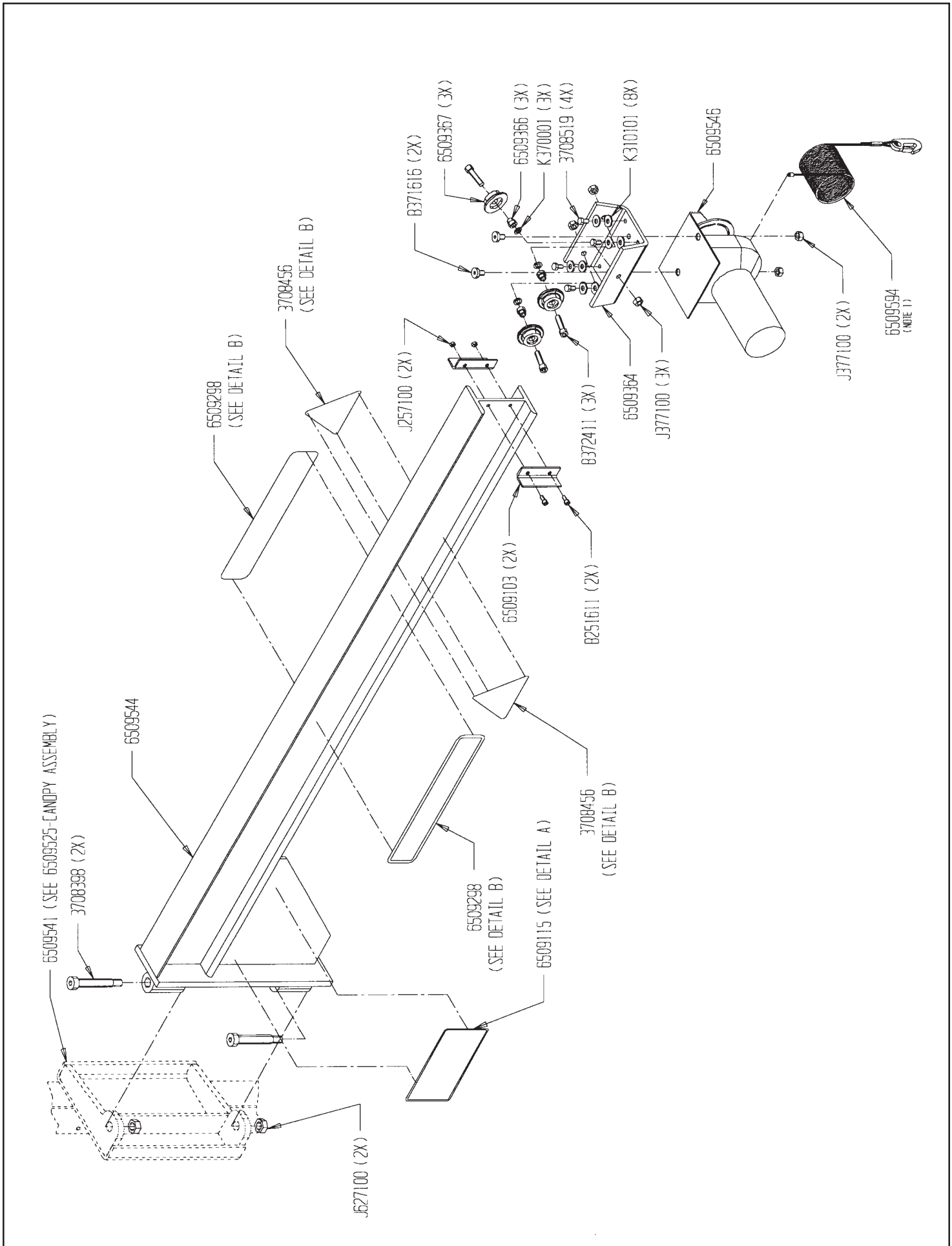
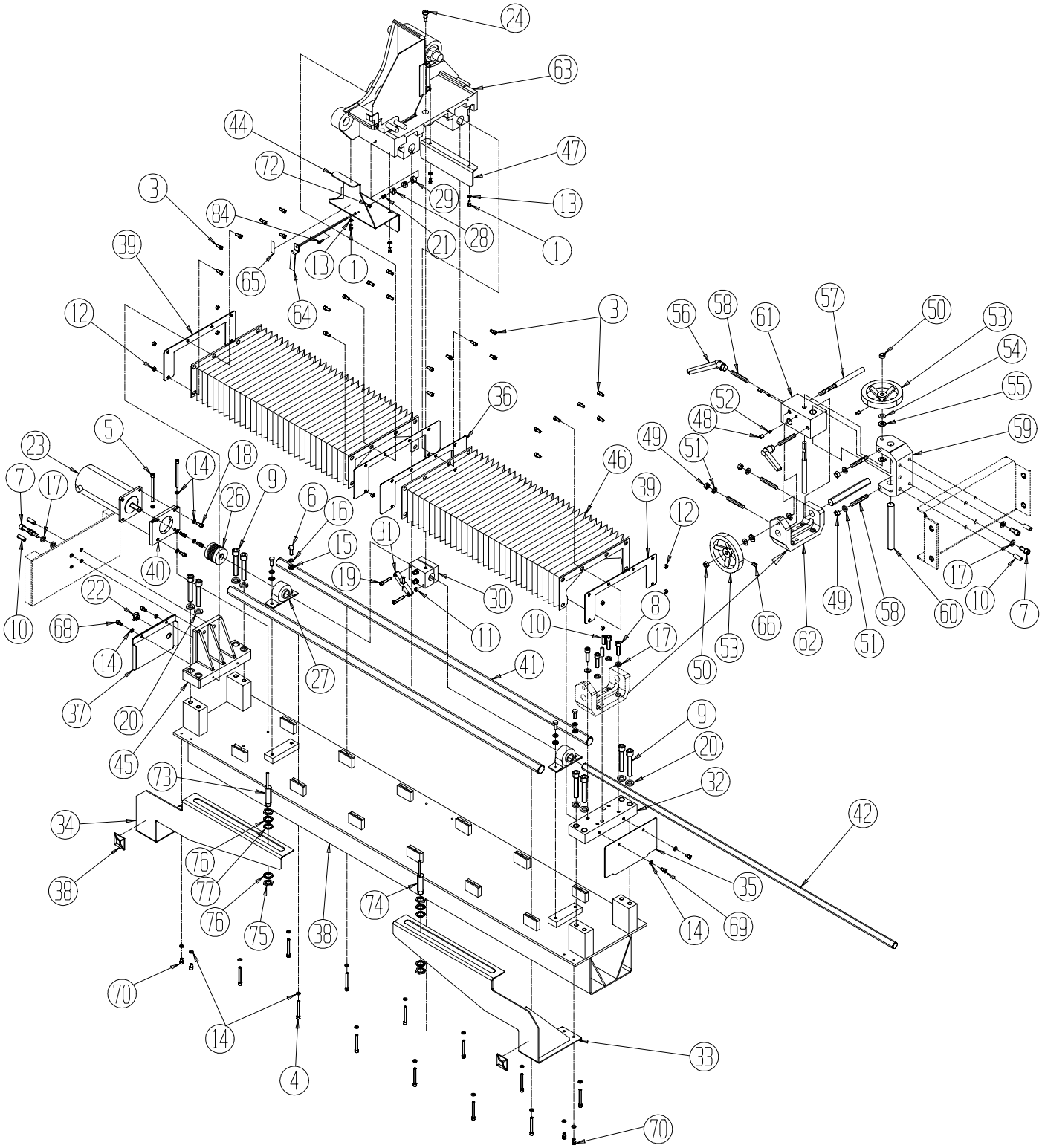

B371616 (2X)
6509367 (3X)
6509366 (3X)
K370001 (3X)
3708519 (4X)
K310101 (8X)
6509546
6509594
(NOTE 1)
J377100 (2X)
3708456
(SEE DETAIL B)
6509298
(SEE DETAIL B)
J257100 (2X)
B372411 (3X)
6509364
J377100 (3X)
6509103 (2X)
B251611 (2X)
6509544
6509541 (SEE 6509525-CANOPY ASSEMBLY)
3708398 (2X)
6509298
(SEE DETAIL B)
6509115 (SEE DETAIL A)
3708456
(SEE DETAIL B)
J627100 (2X)

DIAGRAM NO.	PART. NO.	DESCRIPTION
1	B251611	Socket Head Cap Screw 1/4-20 x 1 Long
2	J257100	1/4-20 Nylok Locknut
3	J627100	5/8-11 Locknut
4	6509541	Canopy Frame Weldment
5	3708398	Shoulder Bolt, .75 Dia. x 3.5 Long
6	6509103	Trolley stop Bracket
7	6509115	Winch Warning Decal
8	6509544	Boom Weldment
9	B371616	Button Head Socket Cap Screw 3/8-16 x 1" Long
10	J377100	3/8-16 Hex Jam Nylok Locknut
11	3708519	5/16-18 x 1/2 Nylon HHCS
12	6509298	Decal - Boom Cap
13	B372411	3/8-16 x 1.50 SHCS
14	6509367	Trolley Wheel Assy
15	6509594	Hook and Cable Assembly
16	6509546	Electric Winch
17	6509364	Trolley Base
18	3708456	Decal - Boom Capacity Symbol
19	K310101	5/16 Flat Washer
20	6509366	Spacer - Trolley Wheel
21	K370001	3/8 Flat Washer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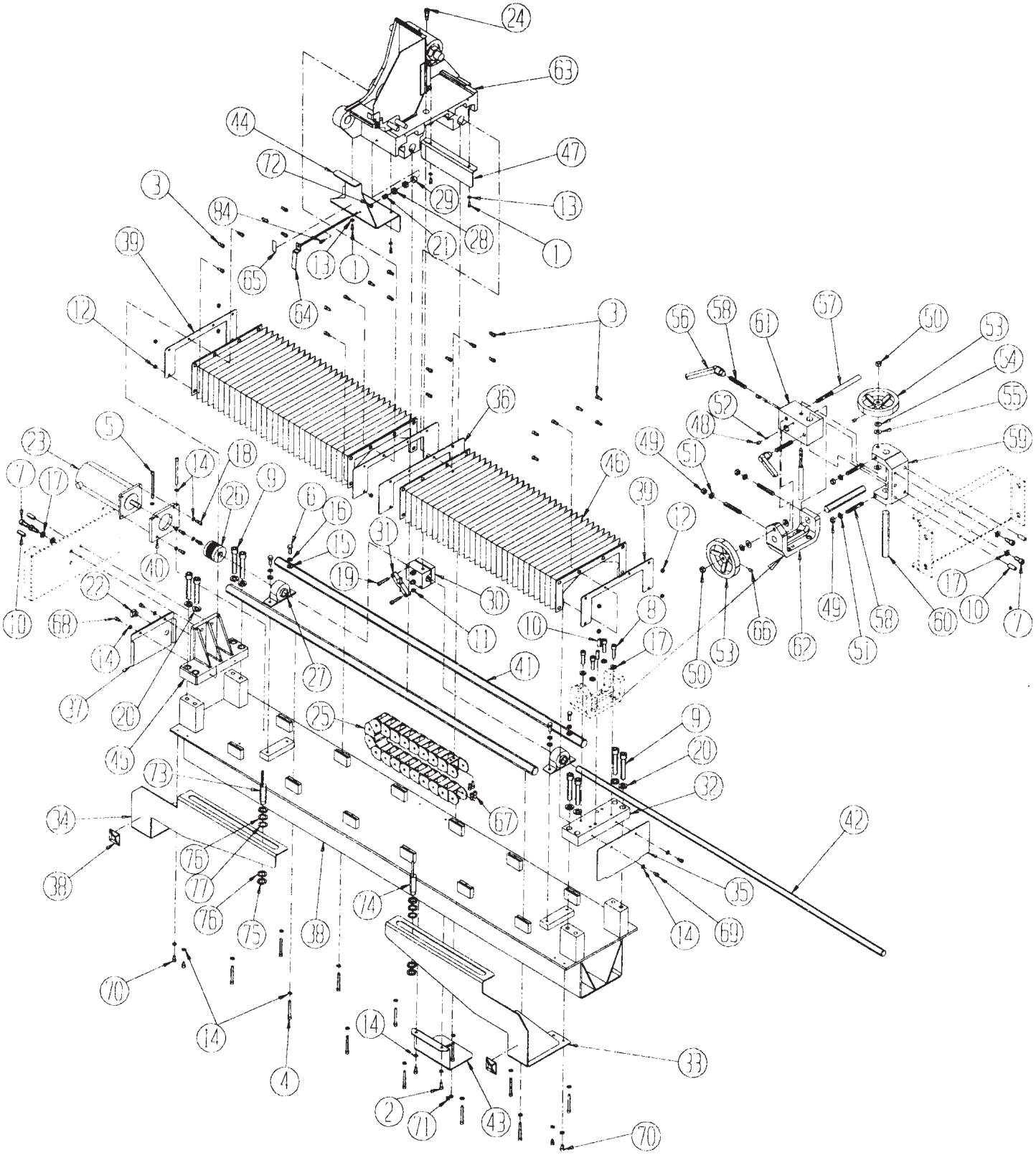
PARTS LIST (Continued) 6509530 TRAVERSE AND CARRIAGE ASSEMBLY

DIAGRAM NO.	PART NUMBER	DESCRIPTION
1	B190611	Socket Head Cap Screw 10-24 x 3/8 Long
3	B250819	Button Head Socket Cap Screw 1/4-20 x 1/2 Long
4	B253211	Socket Head Cap Screw 1/4-20 x 2 Long
5	B255211	Socket Head Cap Screw 1/4-20 x 3.25 Long
6	B311201	Hex Head Cap Screw 5/16-18 x 3/4 Long
7	B371211	Socket Head Cap Screw 3/8-16 x 3/4 Long
8	B372011	Socket Head Cap Screw 3/8-16 x 1 1/4 Long
9	B503211	Socket Head Cap Screw 1/2-13 x 2 Long
10	H371602	Rollpin 3/8 Dia. x 1 Long
11	J251000	1/4-20 Hexnut
12	J257100	1/4-20 Nylok Locknut
13	K191501	No. 10 Washer
14	K251501	1/4 Split Lockwasher
15	K310001	5/16 Flatwasher
16	K311501	5/16 Split Lockwasher
17	K371501	3/8 Split Lockwasher
18	B251211	Socket Head Cap Screw 1/4-20 x 3/4 Long
19	B252011	Socket Head Cap Screw 1/4-20 x 1 1/4 Long
20	K501501	1/2 Split Lockwasher
21	3619224	Compression Spring
22	3707279	Strain Relief .30 Wire
23	6509338	Traverse Motor Assy (1180 RPM)
24	3708147	Shoulder Bolt .375 Dia. x .625 Long
26	3709583	Flexible Coupling
27	3709635	Pillow Block Bearing
28	6009152	Shaft Collar
29	6009153	Rubber Washer
30	6509343	Actuator .38 Lead
31	6009548	Actuator Bar Assembly
32	6509010	Traverse Base Adjuster Bracket
33	6509560	R. H. Proximity Bracket
34	6509561	L. H. Proximity Bracket
35	6509020	Traverse Base Adjustable End Cap
36	6509021	Bellows Carriage Mounting Bracket
37	6509553	Fixed End Cap Weldment
38	6509024	Machined Traverse Base
39	6509025	Bellows End Mounting Bracket
40	6509061	Motor Mount Bracket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PARTS LIST (Continued) 6509530 TRAVERSE AND CARRIAGE ASSEMBLY

DIAGRAM NO.	PART NUMBER	DESCRIPTION
41	6509063	Carriage Shaft
42	6509065	Carriage Drive Shaft
44	6509211	Carriage Proximity Flag Bracket
45	6509221	Fixed Traverse Base Bracket
46	6509250	650 Way cover Bellows
47	6509253	Carriage Dust Cover Bracket
48	C311220	Socket Set Screw CPPT 5/16-18 x 3/4 Long
49	J371000	3/8-16 Hex Nut
50	J377000	3/8-16 Hex Jam Nylok Locknut
51	K371501	3/8 Split Lockwasher
52	3579109	3/16 Dia. Nylon Plug
53	3708148	Handwheel 4/5 Dia. .38 Bore
54	3709062	Bell V Washer .75 O.D. x .035 T
55	3709304	Thrust Washer
56	3709437	Adjustable Handle 3/8-16 Female
57	6009036	Adjusting ACME Shaft
58	6009035	Locking Stud Shaft
59	6009082	Cross Slide Support
60	6009095	Slide Shaft
61	6509011	Cross Slide
62	6509015	Cross Slide Horizontal Support
63	6509566	Carriage Sub Assembly
64	6509585	Release Arm Weldment
65	3708454	Release Decal
66	C310820	Socket Set Screw 5/16-18 x 5/8 Long
68	B250811	Socket Head Cap Screw 1/4-20 x 1/2 Long
69	B250616	Button Head Cap Screw 1/4-20 x 3/8 Long
70	B251011	Socket Head Cap Screw 1/4-20 x 5/8 Long
71	J257000	1/4-20 Locknut
72	6509321	10-24 Locknut
73	6509321	Proximity Sensor - Wire 11
74	6509322	Proximity Sensor - Wire 12
75	3707459	Proximity Sensor Nut
76	3708421	Flat Washer, .75 x 1.00 x .075
77	3708419	Wave Washer, .78 I.D.
78	3707224	Cable Tie Holder - Typical Used Throughout Machine
79	3709668	Socket Head Screw
80	3709597	Sealed Bearing
81	3709596	Spacer
82	3709469	Compression Spring
83	K250001	1/4" Flat Washer
84	B190811	Socket Head Cap Screw 10-24 x 1/2 Long

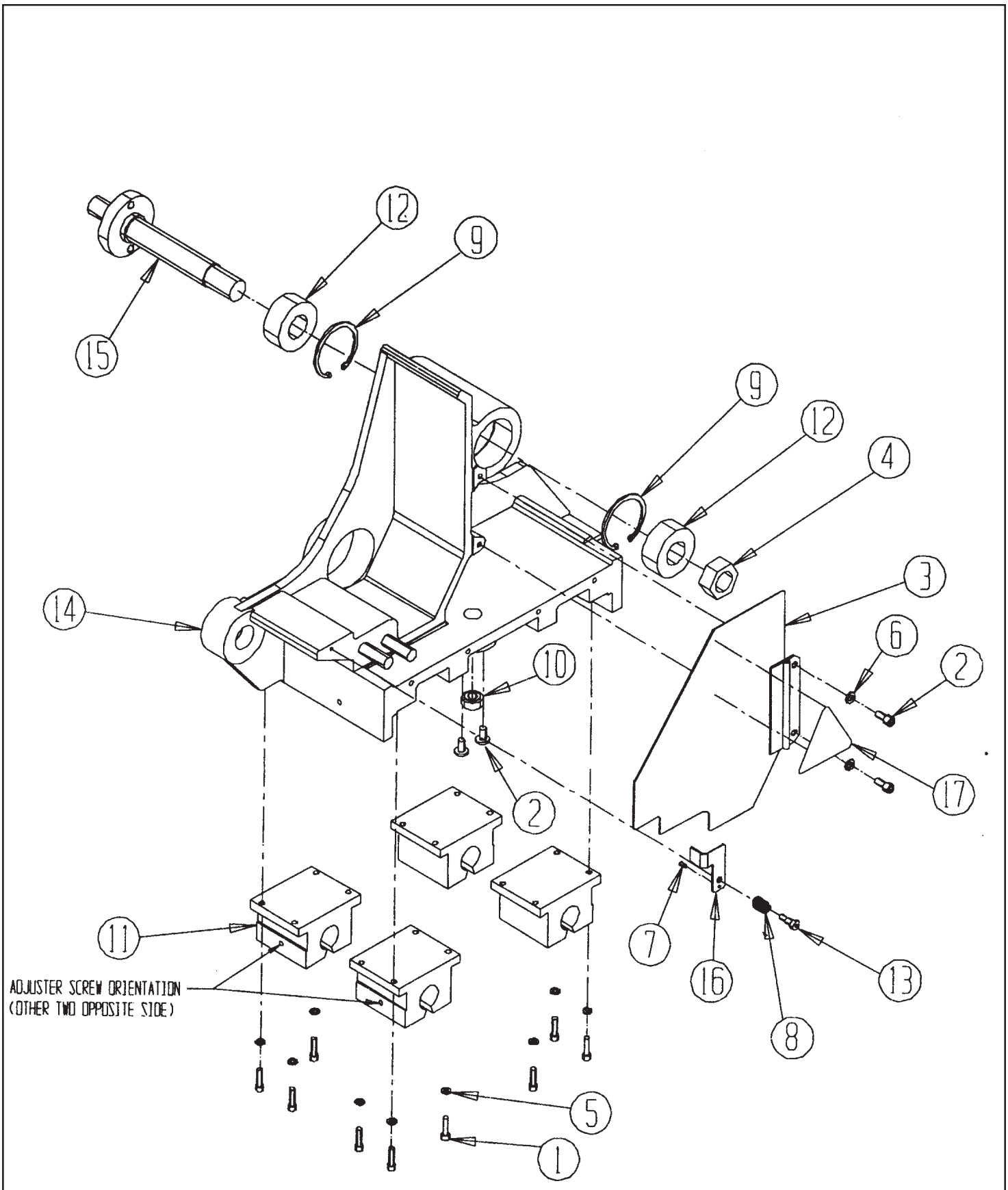
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DIAGRAM NO.	PART NUMBER	DESCRIPTION
1	B191211	Socket Head Cap Screw 10-24 x 3/4 Long
2	B250616	BS Head Cap Screw 1/4-20 x .38 Long
3	6509584	Swind Door Weldment
4	J887300	7/8-14 Nylok Jam Locknut
5	K191501	No. 10 Lockwasher
6	K251501	1/4 Split Lockwasher
7	R602031	#4 x .31 Drive Screw
8	3708105	Compression Spring
9	3708184	Retaining Ring
10	3709040	Spherical Bearing
11	3709044	Ball Bushing Bearing
12	3708186	Ball Bearing
13	3708208	Shoulder Bolt .250 Dia. x .387 Long
14	6509019	Carriage Base
15	6509023	Grinder Head Pivot Shaft
16	6509251	Swing Door Latch
17	3708462	Decal - RPM, Symbol

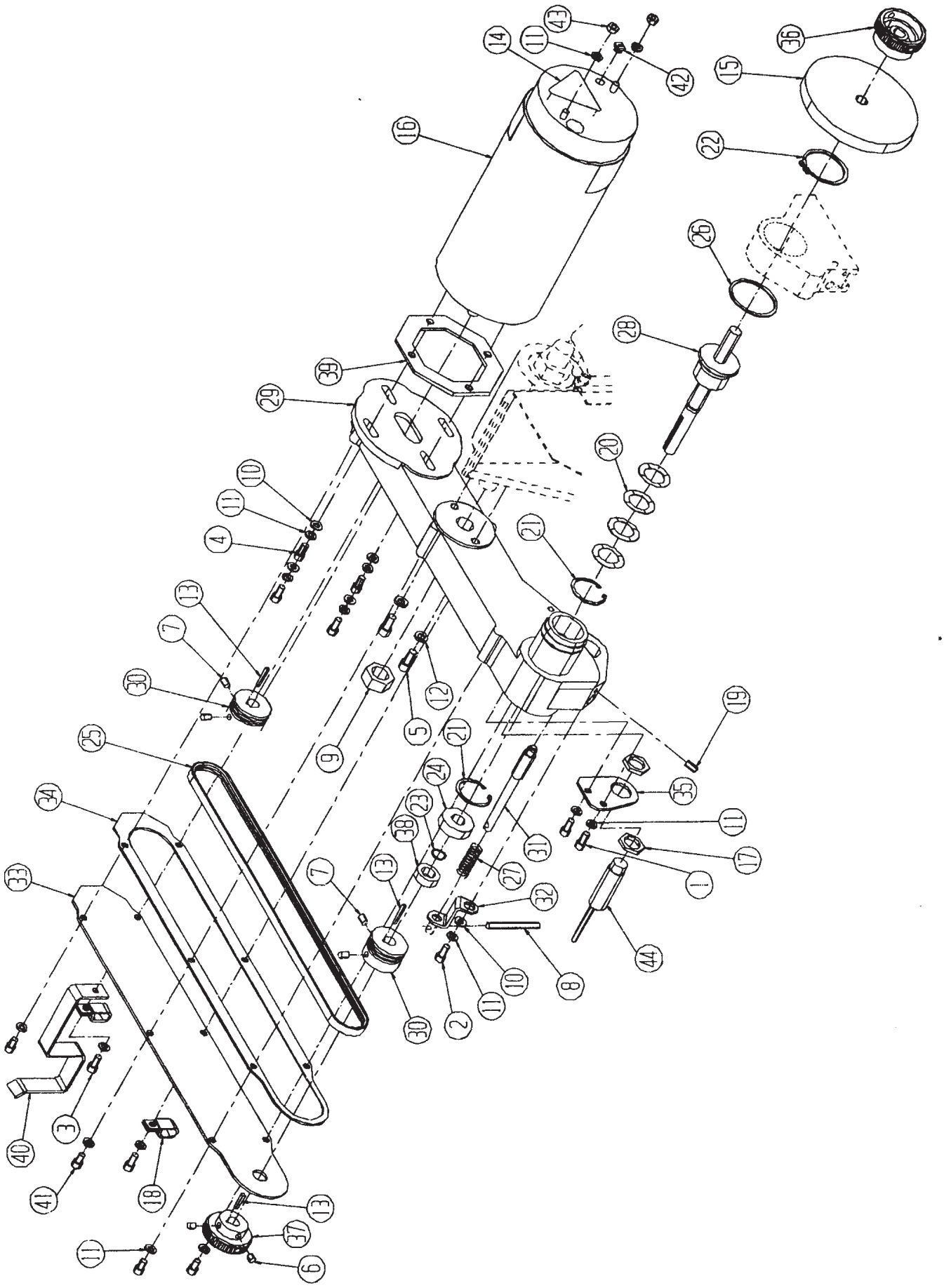
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DIAGRAM NO.	PART NUMBER	DESCRIPTION
1	B250618	Pan Head Machine Screw 1/4-20 x 3/8 Long
2	B250811	Socket Head Cap Screw 1/4-20 x 1/2 Long
3	B251016	Button Head Socket Cap Screw 1/4-20 x 5/8 Long
4	B251611	Socket Head Cap Screw 1/4-20 x 1 Long
5	B311611	Socket Head Cap Screw 5/16-18 x 1 Long
6	C250420	Socket Set Screw 1/4-20 x 1/4 Long
7	C250620	Socket Set Screw 1/4-20 x 3/8 Long
8	H254009	Drive Loc. Pin 1/4 x 2.5 Long
9	J757300	3/4-16 Full Nylok Locknut
10	K250001	1/4 Flatwasher
11	K251501	1/4 Split Lockwasher
12	K311501	5/16 Split Lockwasher
13	R000376	Square Key 1/8 x 3/4" Long
14	3708448	Warning Decal--Electrical
15	3700089	Grinding Wheel 5" Dia. x .50 W
16	3707023	DC Motor 1 HP 90V
17	3707459	Proximity Sensor Nut
18	3708121	Double Tube Clamp
19	3708159	Spiral Pin 1/4 Dia. x .50 Long
20	3708193	Conical Washer
21	3708194	Internal Retaining Ring 5000-137
22	3708195	External Retaining Ring 5100-187
23	3708196	Internal Retaining Ring 5100-59
24	3708204	Ball Bearing
25	3708202	Poly V Belt
26	3708436	Wave Spring
27	3709072	Compression Spring
28	6509578	Grinding Head Spindle Assembly
29	6509018	Grinding Head Housing
30	6509052	Poly V Pulley
31	6509527	Plunger Pin Assembly
32	6509054	Plunger Pin Retainer
33	6509055	Belt Cover
34	6509210	Belt Cover Gasket
35	6509216	Proximity Finger Stored Bracket
36	6509237	Grinding Wheel Knob
37	6509238	Grip Grinding Wheel Knob
38	6509247	Pulley Spacer
39	6509256	Motor Spacer
40	6509269	Vacuum Hose Bracket
41	B250818	Button Head Cap Screw 1/4-20 x 1/2
42	3707273	Strain Relief
43	J257100	1/4-20 Locknut
44	6509325	Proximity Sensor - Wire 15

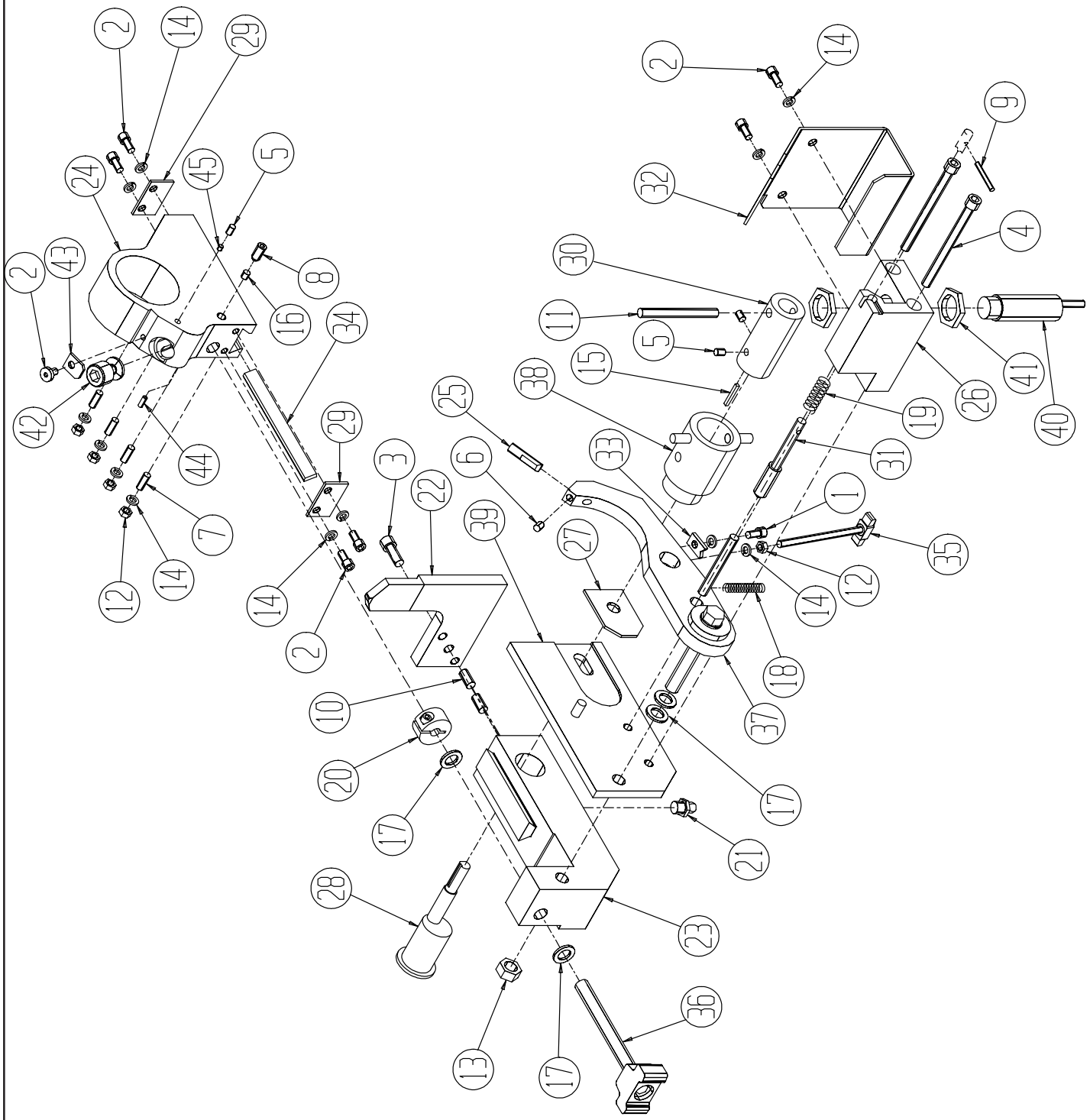
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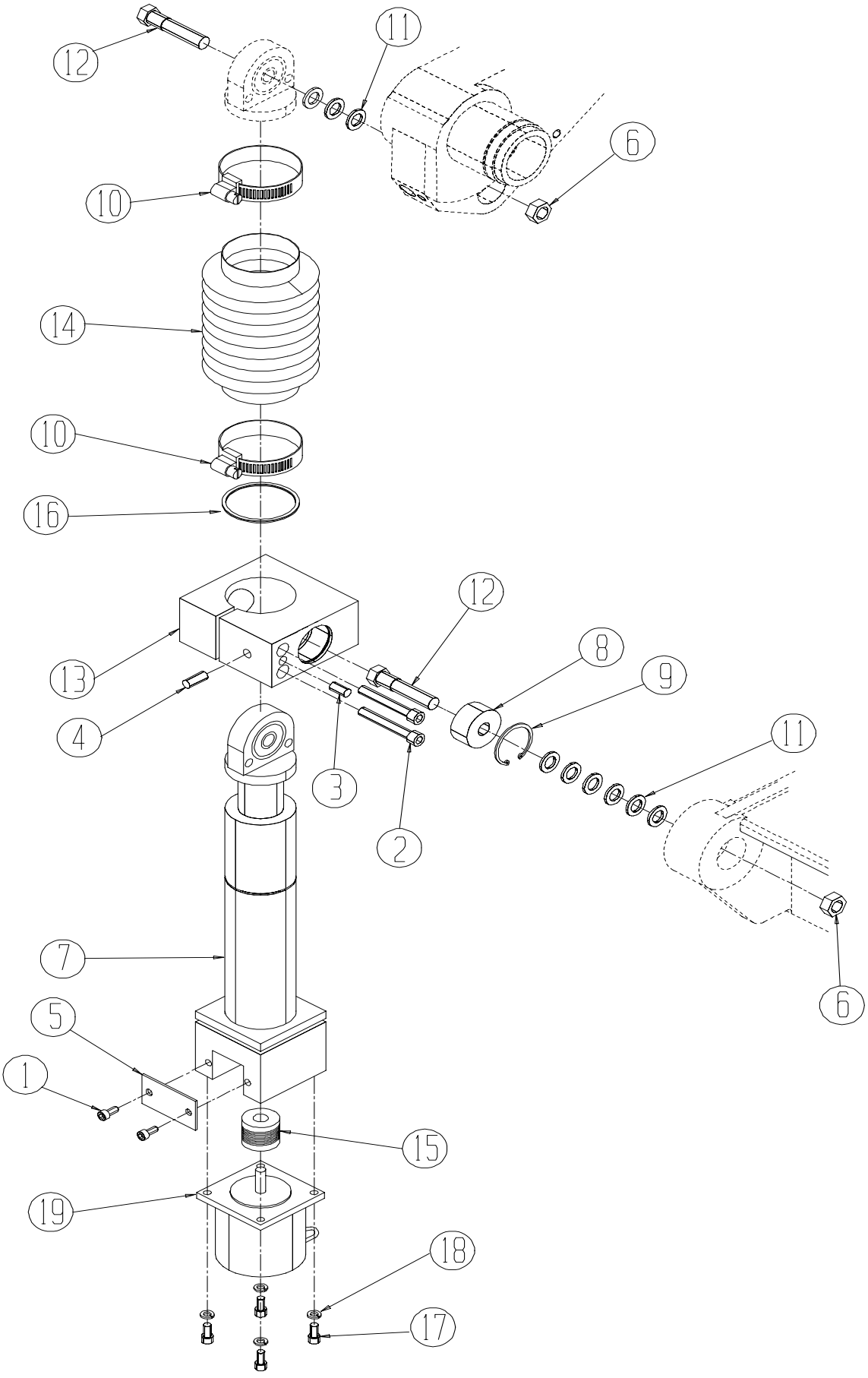
DIAGRAM NO.	PART NUMBER	DESCRIPTION
1	B190631	Socket Head Cap Screw 10-32 x 3/8 Long
2	B190634	Button Head Socket Cap Screw 10-32 x 3/8 Long
3	B251011	Socket Head Cap Screw 1/4-20 x 5/8 Long
4	B254811	Socket Head Cap Screw 1/4-20 x 3 Long
5	C190460	Socket Set Screw 10-32 x 1/4
6	C190467	Socket Set Screw - Nylok Cup 10-32 x .25 Long
7	C190860	Socket Set Screw - CP-Pt 10-32 x 1/2 Long
8	C250825	Socket Set Screw - 1/4-20 x 1/2 Long
9	H122002	Roll Pin 1/8 Dia. x 1 1/4 Long
10	H250813	Dowel Pin 1/4 Dia. x .5 Long
11	H254009	Drive Lock Pin 1/4 x 2.5 Long
12	J191100	10/32 Hex Nut
13	J377200	3/8-24 Jam Nylok Locknut
14	K191501	No. 10 Lock Washer
15	R000351	Square Key .093 x .75 Long
16	3579109	3/16 Dia. Nylon Plug
17	3709304	Thrust Washer
18	3708107	Compression Spring
19	3708175	Compression Spring
20	3708199	3/8-16 Dia. Split Shaft Collar
21	3709472	Straight Grease Fitting
22	6509002	Relief Finger
23	6509004	Reel Finger Slide
24	6509357	Reel Finger Positioner
25	6509007	Index Stop Pin
26	6509008	Index Sensor Block
27	6509009	Slide Washer
28	6509058	Eccentric Index Pin
29	6509060	Gib Stop Plate
30	6509215	Adjustable Index Lever
31	6509229	Locking Index Finger Pin
32	6509230	Index Sensor Guard
33	6509239	Anti Rotation Plate
34	6509258	Dovetail Gib
35	6509501	Tee Knob assembly
36	6509547	Knob Assembly
37	6509572	Index Finger Assembly
38	6509591	Index Lock Handle Weldment
39	6509592	Index Finger Positioner Weldment
40	6509326	Proximity Sensor - Wire 16
41	3707459	Proximity Sensor Nut
42	6509356	Reel Positioner Adjuster
43	6509358	Stop Plate
44	H120402	1/8" Diameter x 1/4" Long Roll Pin
45	3579284	1/8" Diameter Nylon Plug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PARTS LIST (Continued) 6509574 STEPPER & MOUNTING ASSEMBLY

DIAGRAM NO.	PART NUMBER	DESCRIPTION
1	B160607	Button Head Cap Screw 8 -32 x 3/8 Long
2	B252811	Socket Head Cap Screw 1/4-20 x 1 3/4 Long
3	C250825	Socket Set Screw 1/4-20 x 1/2
4	C251020	1/4-20 x 5/8" Set Screw
5	H371202	Roll Pin 3/8 Dia. x .75 Long
6	J377200	3/8-24 Nylok Jam Locknut
7	K251501	Infeed Stepper Assy.
8	3708187	Ball Bearing
9	3708189	Retaining Ring
10	3708192	Hose Clamp 2.25 Dia.
11	3709304	Thrust Washer
12	6509048	Hex Pivot Pin
13	6509051	Trunion Block
14	6509056	Bellows, 1.88 I. D.
15	37086289	Flex Coupling
16	3708424	Spiral Retaining Ring
17	B190811	Socket Head Cap Screw 10-24 x 1/2 Long
18	K191501	No. 10 Lock Washer
19	6509503	Stepper Infeed Motor

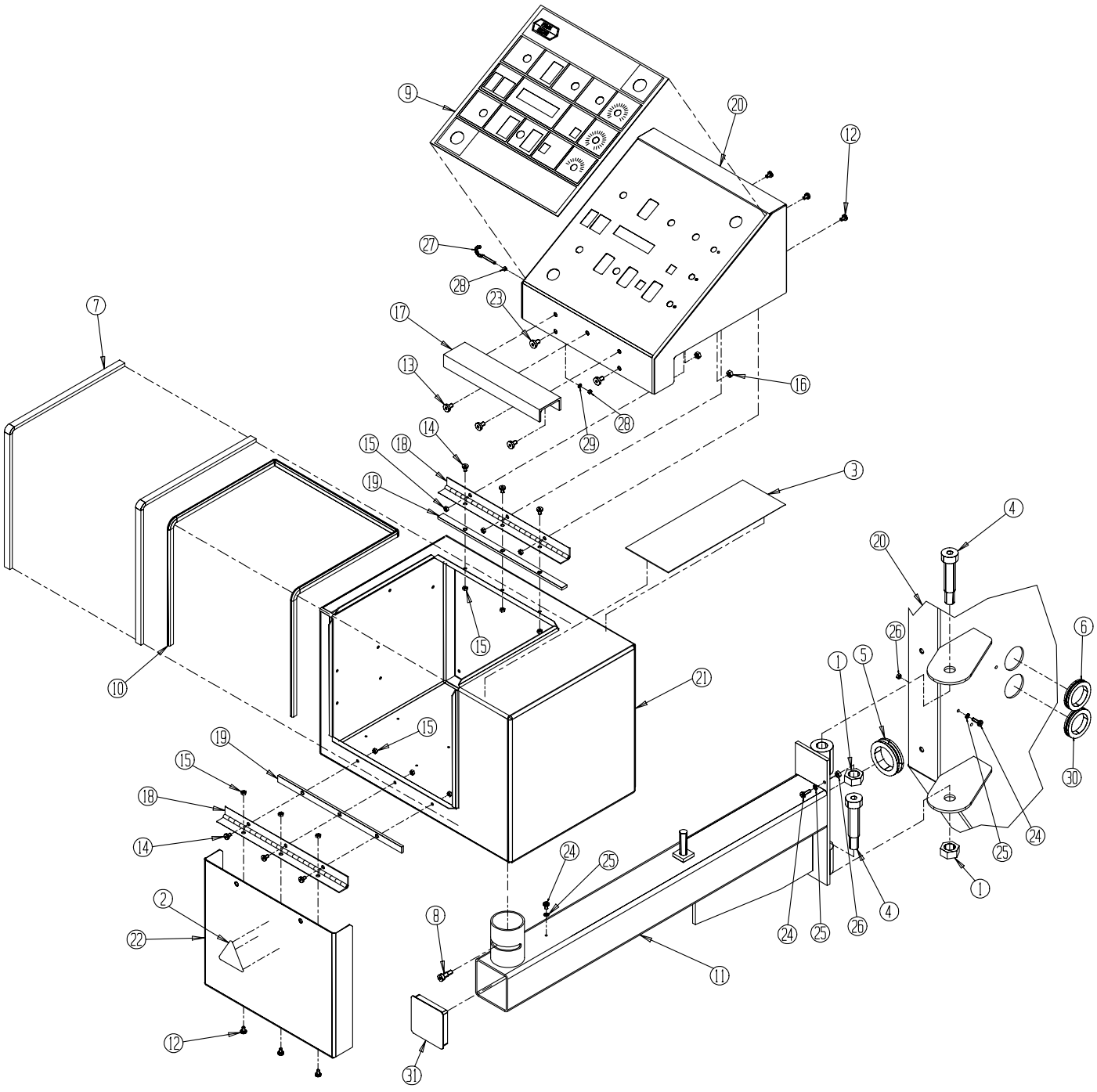
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DIAGRAM NO.	PART NUMBER	DESCRIPTION
1	J627100	Full Nylok Locknut 5/8-11 Long
2	3708448	Warning Decal
3	3708203	Rubber Pad
4	3708371	Shoulder Bolt .75 Dia. x 2.25 Long
5	3708375	Grommet 1.75 I.D. .25 Groove
6	3708376	Grommet 1.50 I.D. .125 Groove
7	3708378	Foam Strip
8	3708425	Shoulder Bolt .312 Dia. x .375 Long
9	6509314	Control Panel Decal
10	6509096	Rubber Trim
11	6509558	Control Arm Weldment
12	B190834	Button Head Cap Screw 10-32 x 1/2 Long
13	B250816	Button Head Socket Cap Screw 1/4-20 x 1/2 Long
14	B191034	Button Head Cap Screw 10-32 x 5/8 Long
15	J197300	10-32 Locknut
16	J257000	1/4-20 Nylok Inst. Locknut
17	6509112	Handle
18	6509212	Control Panel Hinge
19	6509213	Control Panel Hinge Spacer
20	6509504	Top Swing Panel Weldment
21	6509570	Control Box Weldment
22	6509575	Front Swing Panel Weldment
23	B250816	Button Head Socket Cap Screw 1/4-20 x 1/2 Long
24	B190809	Phillip Head Cap Screw 10-24 x 1/2
25	R000483	#10 Toothed Lock Washer
26	J197000	10-24 Lock Nut
27	3708426	Chart Holder Hook
28	J161000	8-32 Nut
29	K161501	#8 Lockwasher
30	3708427	3" Square Plug

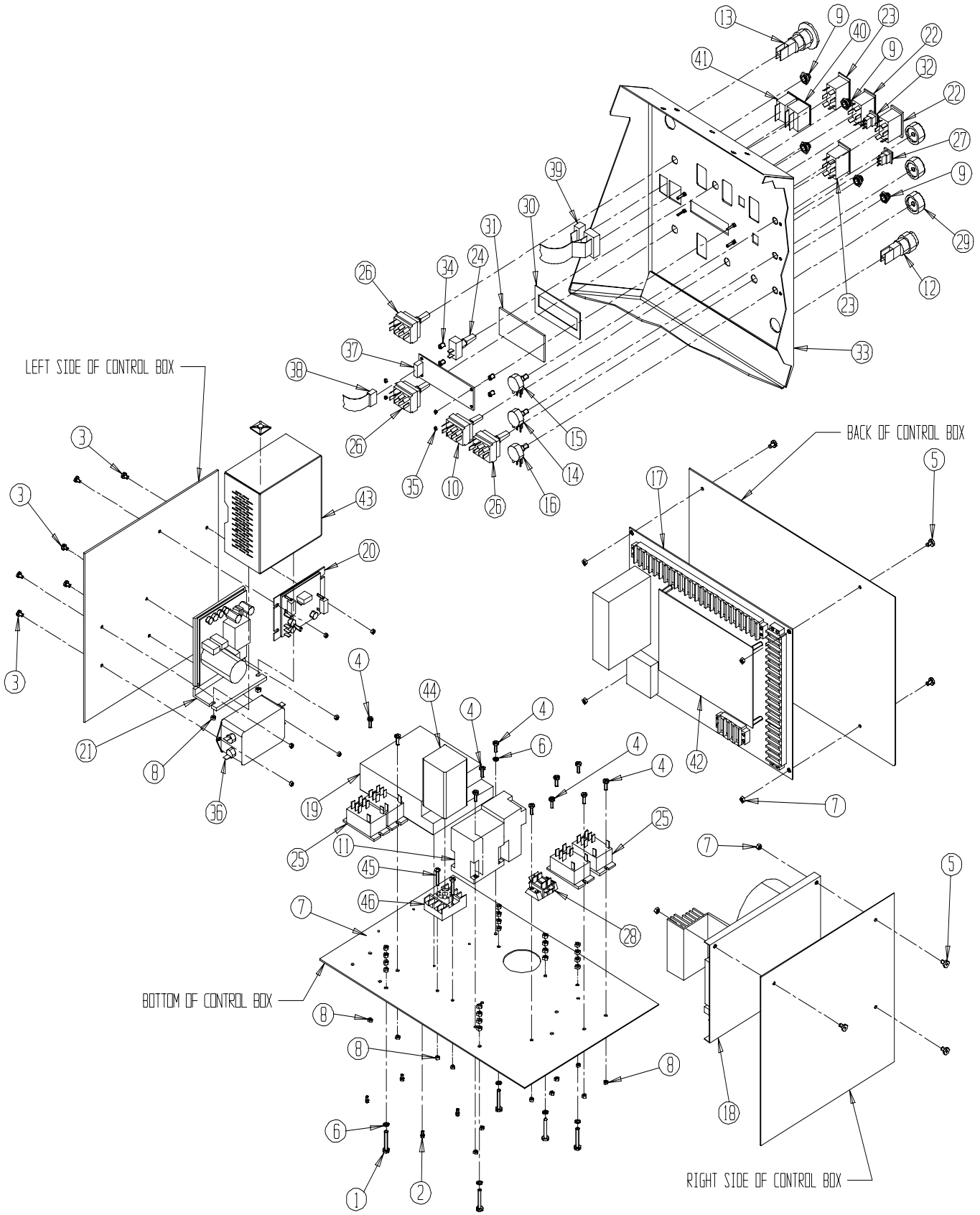
LEFT SIDE OF CONTROL BOX
BACK OF CONTROL BOX
BOTTOM OF CONTROL BOX
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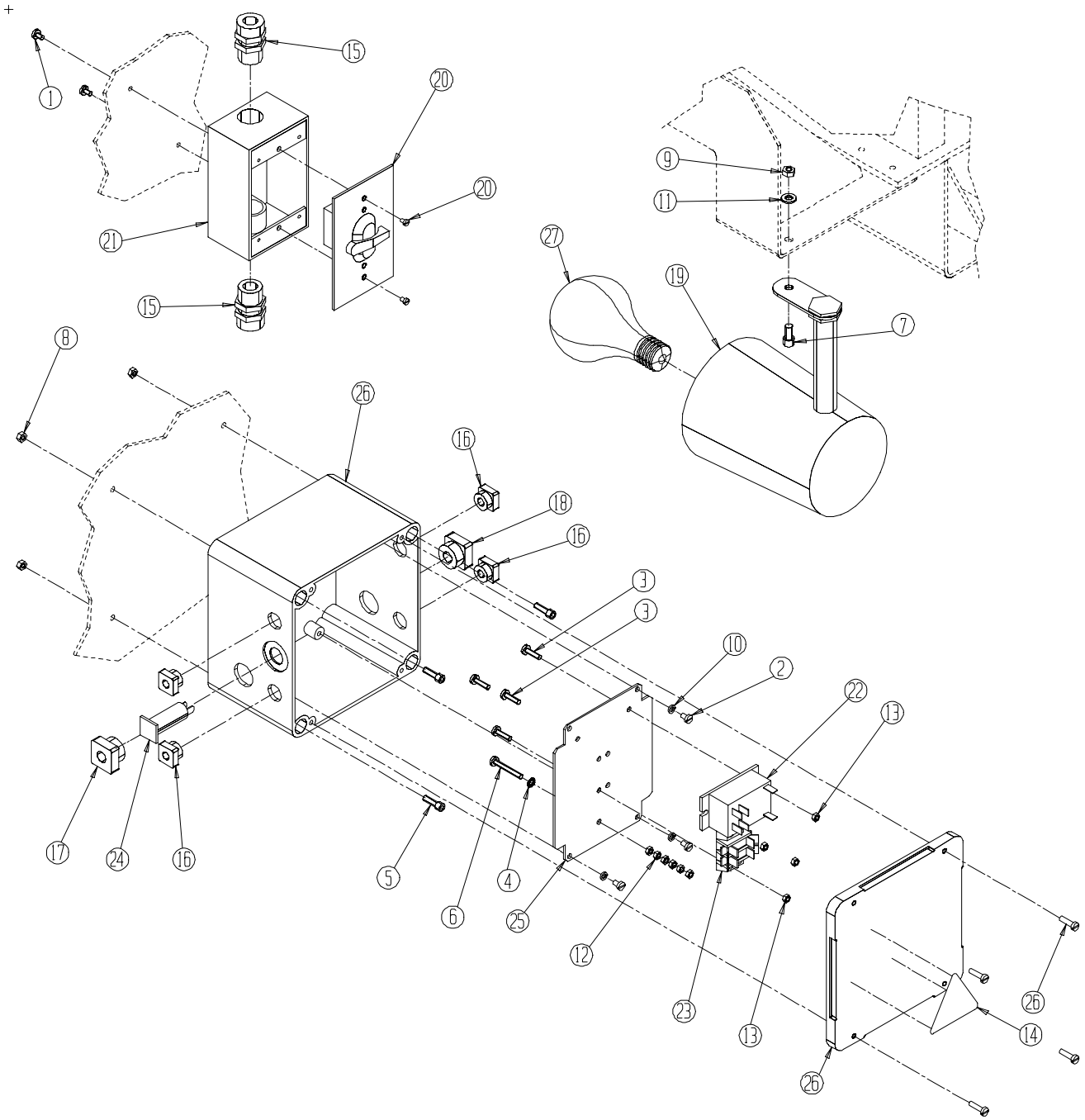
DIAGRAM NO.	PART NUMBER	DESCRIPTION
1	B192013	Button Head Socket Cap
2	B110406	Socket Head Cap Screw 4-40 x 1/4
3	B160807	Button Head Cap Screw 8-32 x .50
4	B161014	Phillips Head Machine Screw 8-32 x 5/8
5	B190813	Button Head Cap Screw 10-24 x .50
6	K191501	#10 Lock Washer
7	R000553	10-24 Kep Nut
8	R000558	8-32 Kep Nut
9	3707075	Toggle Switch Boot
10	3707080	Toggle Switch-Spin Rotation FWD/REV
11	3707087	1 HP Magnetic Starter
12	3707088	Start Pushbutton
13	3707089	Stop Pushbutton
14	6509310	50K .25 Term. Potentiometer-Relief Torque
15	6509309	10K Stripped Potentiometer-Traverse Speed
16	6509311	10K Potentiometer-Spin Speed
17	3707420	Control Module
18	3707421	DC Drive Module (Rev)
19	3707436	Stepper Control Module
20	6509315	Spin Drive Control
21	3707425	Control Board 1 HP
22	3707428	On-Off-On Mom. Rocker Switch
23	3707429	On-Off Rocker Switch
24	3707430	Toggle/Paddle Switch
25	3707431	24V DC Coil Relay
26	3707432	4 Pole Toggle Switch
27	3707434	Unlighted Square Pushbutton
28	3707439	.25 Spade Terminal Block
29	3707446	Pointer Knob with Pot.
30	6509132	LCD Window Gasket
31	6509133	LCD Window
32	6509593	Reset Switch Assembly
33	6509504	Control Panel Weldment
34	6509064	LED spacer
35	J117000	4-40 Locknut
36	3707403	Filter Powerline - 10A
37	3707452	LCD Display
38	3707453	LCD Ribbon Cable
39	3707454	Counter Ribbon Cable
40	3707455	2 Digit Counter
41	3707456	Single Digit Counter
42	3707457	I/O Controller Circuit Board
43	6509554	Box Shield
44	3707074	Voltage Sensor Relay
45	B161614	Phillips Pan Head Screw 8-32 x 1
46	3707073	8 Pin Socket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PARTS LIST (Continued) 6509598 JUNCTION BOX AND LIGHT ASSEMBLY

DIAGRAM NO.	PART NUMBER	DESCRIPTION
1	B160607	Button Head Socket Cap Screw 8-32 x 1/4
2	B160414	Phillip Head Mach. Screw and Panel Junction 8-32x1/4
3	B161014	Phillip Head Mach. Screw 8-32 x 5/8
4	R000483	#10 Lock Washer
5	B191031	Socket Head Cap Screw 10-32 x 5/8
6	B192013	Button Head Socket Cap-Full Thread 10-24 x 1.25
7	B251201	Hex Head Cap Screw 1/4-20 x 3/4
8	J197300	10-32 Lock Nut
9	J257100	1/4-20 Nylok Lock Nut
10	K161501	No. 8 Lock Washer
11	K250101	Flat Washer
12	R000553	10-24 Kep Nut
13	R000558	8-32 Kep Nut
14	3708448	Warning Decal
15	3707180	Liquid Tight Connector
16	3707273	Strain Relief Wire .33/.36
17	3707275	Strain Relief Wire .37/.43
18	3707294	Strain Relief Wire .43/.47
19	6509340	4" Stem Machine Light
20	3707412	Electrical Box Cover with Switch
21	3707413	Aluminum Electrical Box
22	3707447	DPDT 120VDC Coil Relay
23	3707439	.25 Spade Terminal Block
24	3707444	10 AMP Circuit Breaker
25	6509123	Electric Junction Panel
26	6509262	Junction Box
27	3707046	Rough Service 100 Watt

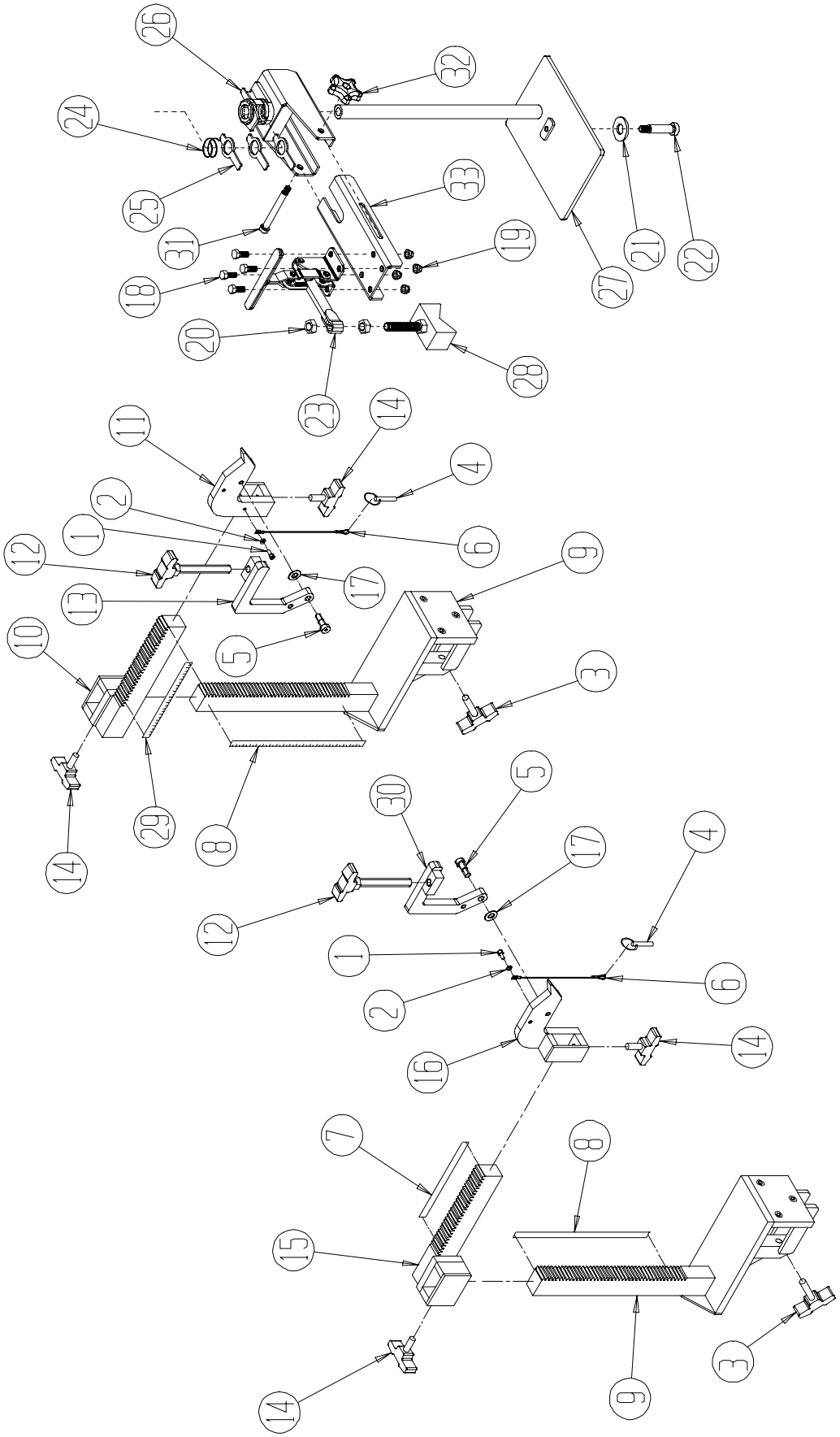
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DIAGRAM NUMBER	PART NUMBER	DESCRIPTION
1	B190614	Pan Head Machine Screw 10-24 x 3/8 Long
2	K191501	No.10 Lockwasher
3	6009577	Knob Assembly
4	3708364	Quick Release Pin .31 Dia.
5	3708158	Shoulder Bolt .375 Dia. x .50 Long
6	3708366	6" type B Lanyard
7	6509128	Horizontal Scale Decal RH
8	6509129	Vertical Scale Decal
9	6509507	Bar Mounting Weldment Bracket
10	6509517	L.H. Front Roller Horiz. Weldment Bracket
11	6509518	L. H. Roller Clamp Weldment Bracket
12	6509559	Knob Assembly
13	6509564	L.H. Front Roller Clamp Weldment
14	6509588	Knob Assembly
15	6509515	R.H. Front Roller Horiz. Welment Bracket
16	6509516	R.H. Roller Clamp Weldment Bracket
17	3709304	Thrust Washer
18	B311201	Hex Head Cap Screw 5/16-18 x 3/4 Long
19	J317100	5/16-18 Nylok Locknut
20	J502000	1/2-13 Hex Jam Nut
21	R000456	Flat Washer .56 x 1.38 x .109
22	3708367	Shoulder Bolt .50 Dia x 1.75 Long
23	6309534	Toggle Clamp
24	3709849	Pony Clamp Spring
25	3709858	Pony Leaf
26	6309532	R.R. Clamp Arm Weldment
27	6309531	R.R. Clamp Base Welment
28	6509545	R.R. Clamp Block Weldment
29	6509304	Horizontal Scale Decal LH
30	6509576	R.H. Front Roller Clamp Weldment
31	3708579	Shoulder Bolt .375 x 3.25 Long
32	3709613	Star Knob
33	6309022	Slide

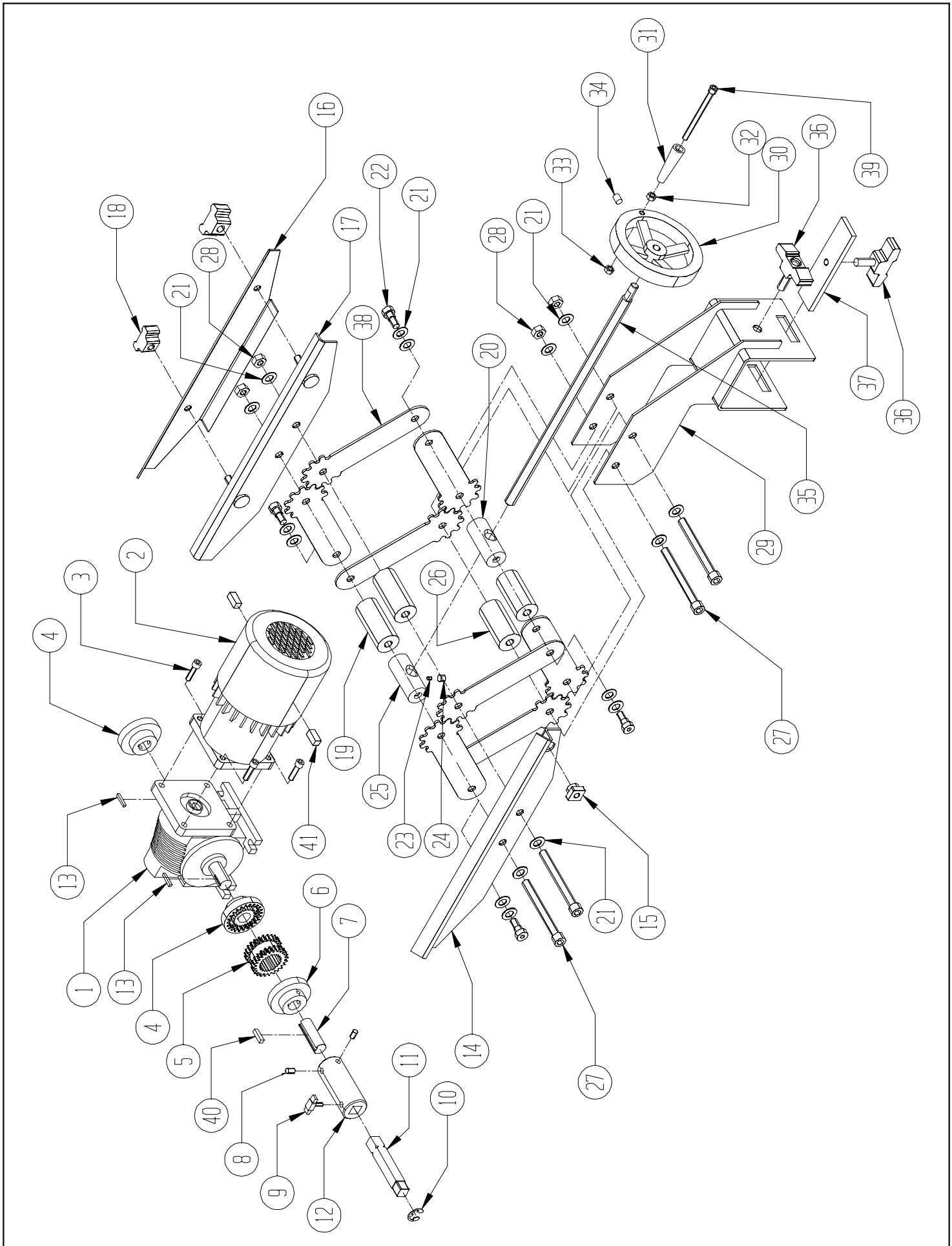
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DIAGRAM NO.	PART NUMBER	DESCRIPTION
1	3708391	Reducer: 10:1 Ratio
2	6509336	Motor, DC .20 HP TEFC
3	B251411	Self Tapping Screw 1/4-20 x 1 Long
4	3709586	Flange Coupler .50
5	3709585	Sleeve Coupler
6	3709584	Flange Coupler 5/8
7	6009053	Drive Coupling Adapter
8	C250620	Socket Set Screw 1/4-20 x 3/8
9	6009598	Tee Knob Assembly .50 Long
10	3709073	Retaining Ring
11	6009051	Drive Adapter 1/2 Square
12	6009052	Adapter
13	R000376	Square Key 1/8 x .75 Long
14	6009078	Gearbox Slide Bracket
15	3707279	Strain Relief Wire
16	6009079	Gearbox Clamp Bracket
17	6009580	Gear Box Slide Weldment Bracket
18	3708262	Knob - Star 5/16-18 Insert
19	6009048	Linkage Spacer 2.29 Long
20	6009046	Linkage Spacer R.H. Thread
21	3709062	Belleville Washer .75 Dia. x .035 T
22	3709809	Shoulder Bolt .375 Dia. x .375 Long
23	3709705	Nylon Ball 5/32 Dia.
24	C310420	Socket Set Screw 5/16-18 x 1/4
25	6009047	Linkage Spacer L.H. Thread
26	6009045	Linkage Spacer 2.5 Long
27	B375611	Socket Head Cap Screw
28	J377100	Nylock Hex Locknut 3/8-16
29	6509519	Support Bracket Weldment
30	3708148	Handwheel 4.5 Dia.
31	3709370	Handle
32	J252000	Hex Jam Nut 1/4-20
33	J257000	1/4-20 Nylok Locknut
34	C310620	Socket Set Screw 5/16-18 x 3/8 Long
35	6009076	Double Thread Rod
36	6009555	Knob Assembly
37	6509114	Spin Drive Plate Lock
38	6009067	Geared Linkage
39	B255011	Socket Head Cap Screw 1/4-20 x 3 1/8 Long
40	R000377	Square Key 3/16 x .75 Long
41	3707254	DC Motor Brush

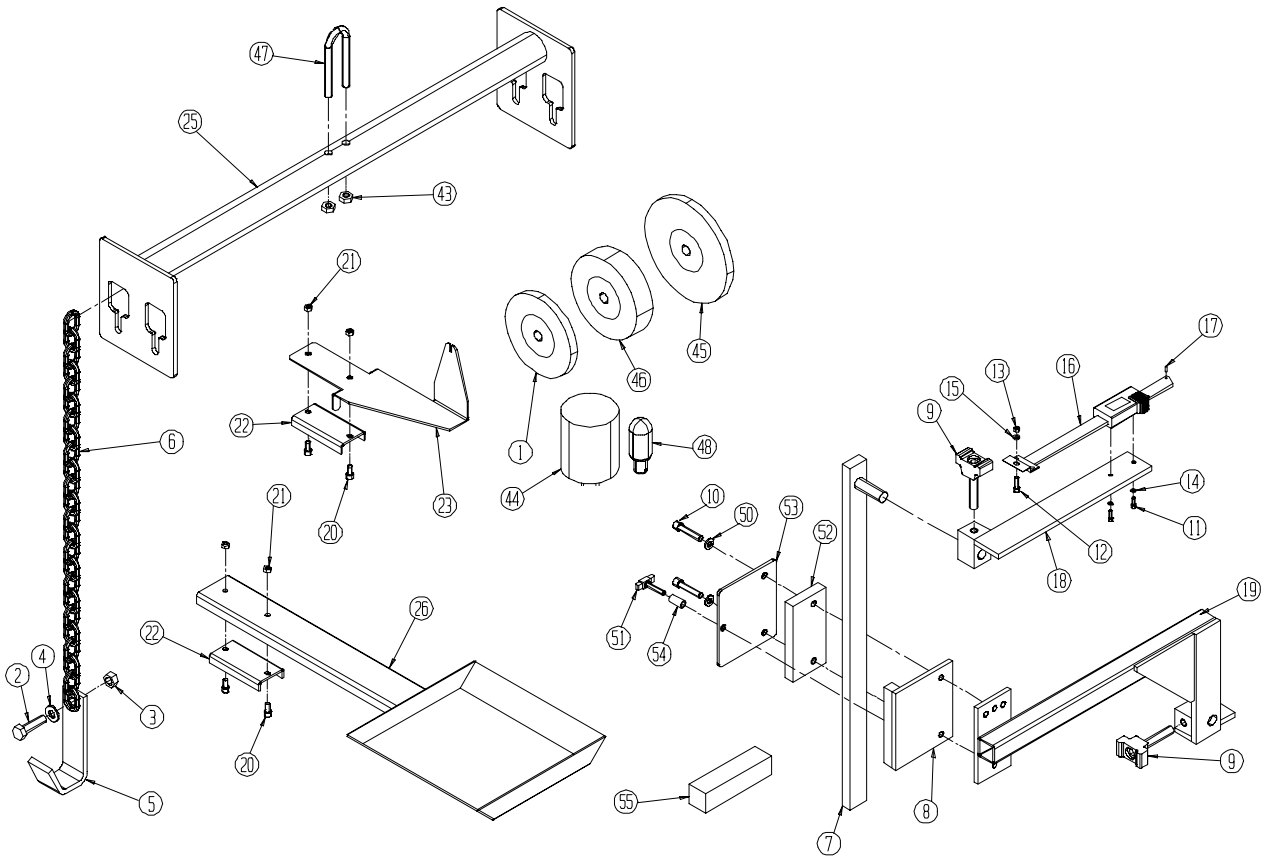
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DIAGRAM NO.	PART NO.	DESCRIPTION
1	3700088	Grinding Wheel 3.5" Dia. x .38 W
2	B371601	Hex Head Cap Screw 3/8-16 x 1 Long
3	J377100	Nylok Locknut
4	K370001	3/8 Flat Washer
5	6009102	Grab Hook
6	6509113	Chain
7	6509569	Gage Bar Assembly-Vertical
8	6509346	Pivot Plate
9	6509567	Knob Assembly
10	B252011	1/4-20 x 1.25 Socket Head Cap Screw
11	B120611	Socket Head Cap Screw 5-40 x .38 Long
12	B161011	Socket Head Cap Screw 8-32 x 5/8 Long
13	J161000	8-32 Hex Nut
14	K121501	No. 5 split Lockwasher
15	K161501	No. 8 Lockwasher
16	6509359	Digital Gage
17	H060302	1/16" x 3/16" Roll Pin
18	6509577	Base Weldment Indicator
19	6509568	Alignment Extension Weldment
20	B190811	Socket Head Cap Screw 10-24 x 1/2
21	J197100	10-24 Nylok Locknut
22	3708384	Magnet
23	6509143	Reel Positioner Gage
25	6509590	Spreader Bar Weldment
26	6509557	Drip Pan Weldment
43	J317100	5/16-18 Lock Nut
44	3707157	Amber Light Assembly (Lense, Socket, Flasher & Bulb)
45	3700087	Grinding Wheel 5" Dia. x .38" Wide
46	3700086	Grinding Wheel 3.5" Dia. x 1" Wide
47	3709316	5/16-18 x 3" U-Bolt 1 1/2"
48	3707465	25W Light Bulb
50	K251501	1/4 Lock Washer
51	6509363	T-Knob Assembly
52	6509350	Retainer Block
53	6509349	Retainer Plate
54	3529069	Spacer
55	3702508	Dressing Stick